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[OFFICIAL NOTICE.]

Fifteenth Annual Meeting, Western Gas Association.

SECRETARY'S OFFICE, WESTERN GAS ASSOCIATION,
QUINCY, ILLS., April 4th, 1892.

The Fifteenth Annual Meeting of the Western Gas Association will be held at Detroit, Mich., on the 18th, 19th and 20th days of May. The Russell House has been designated by the Committee of Arrangements as the headquarters of the Association, while the business sessions will be conducted in the Armory of the Detroit Light Infantry, two blocks distant from the Russell House. The proprietor of the Russell House, Mr. W. H. Chittenden, will take pleasure in reserving rooms for those who may apply in advance of the date of the meeting; and as the gentleman in question, aside from being the proprietor of the hotel, is also one of the Directors of the Detroit Gas Light Company, he will personally see to it that our members are housed in the way that gas men should be accommodated. The Russell House is conducted on the American plan, and the rates for members in attendance, their families and friends, will be $3 per day and upwards, according to location of rooms.

Your Secretary takes this occasion of stating that although no published announcement of the fact has heretofore been made, the special committee for the assignment of papers assembled at St. Louis on the 20th of January last and prepared a list of topics, treatises on which the committee believes will be of interest and value to our members generally. The authors as designated by the committee, almost without exception, acquiesced in the allotment, and several of the papers are already in the hands of your Secretary, while the rest are promised not later than the 25th of the current month, thus giving ample time for printing and illustrating.

It is this manifestation of willingness and zeal for the welfare of "The Western," and hearty and favorable response to requests for the preparation of papers, that lighten the labors of the officers of the Association and contribute so much to a successful meeting.

While the "Question-Box" has long since lost the charm of novelty, there is a feeling on the part of many of our members that our Association has never given this feature of its proceedings the prominence to which its importance entitles it. It has been suggested that we use our best efforts to make this one of the leading features of the Detroit Meeting. It is presumed that the main reason why the Question-Box has been slurred over with us in the way that it has is because the queries were usually put on the spur of the moment, and were as hastily, and, therefore, unsatisfactorily, answered. It is, therefore, recommended that on this occasion our members be requested to send to the Secretary, as far in advance of the date of the meeting as possible, the questions to which they wish replies. Such queries will be promptly announced in these columns, unaccompanied by the names of the senders, thus enabling those who desire to reply to properly prepare and duly weigh their answers before taking the floor for that purpose.

The annual membership list is now in the printers' hands; and each of our members should receive a copy by the 20th of this month. Should any fail to do so, kindly notify the Secretary and the omission will be cheerfully supplied. Application blanks will be mailed to those who may be desirious of joining our Association at its next meeting.

A. W. LITTLETON, Sec.

$2,000 from Toronto.

The machinery of the Gas Industry Council is in swift motion and in harmonious working order, and while we have no official or authoritative advices as to the exact progress made in the matter of actual moneys subscribed by the gas interests towards the erection and equipment of a building at the World's Fair, in Chicago, to be held something over a year from now, to be devoted to the display of gas as an advanced means of lighting and heating our homes, of cooking our food and of driving the varied wheels of our general industries, we nevertheless can say that the building is an assured fact, and that it is to be paid for out of the pockets of the gas men. The project cannot fail; it must not fail. In fact, the subscription at its very inception, without having received any impetus from the spur of general publicity, makes other than an affirmative result unattainable. Our motto, in this instance—paraphrasing the one chosen by one of the most liberal and enlightened

nations of the world—must be written, "Fraternity, liberality, celerity!" The spirit of fraternity must pervade us; the leaven of liberality must temper us; the swiftness of celerity must actuate us. Without other than a circular appeal from the Council, upon the printed lines of which the ink is yet hardly crusted, about 12½ per cent. of the entire sum needed has been pledged, and of this sum the Consumers Gas Company, of Toronto, Canada, through its more than half American, and its completely energetic and whole-souled Manager, Mr. Wm. H. Pearson (the 2d Vice-President of the American Gas Light Association), has caused its name to be entered for the sum of $2,000. This is more than liberal—it is munificent, and goes to show that Mr. Pearson and his associates, residents of what we may term our Sister Republic, are extremists in reciprocity. If Canada guarantees, through one of its gas companies, 1 per cent. of the entire amount necessary to exhibit American gas at its best, can we do else than claim that the Union's gas makers have as much faith in their business, and as much credit at their bankers, as have their brethren who hold allegiance to another flag. Not much; the Union and Canada are united in this respect—as they are in many other respects. Send your subscriptions at once to the Council, and see to it that the standard set by Canada is lived up to. We hope shortly to be authorized by the Council to print the lists of subscribers, and our greatest satisfaction will lie in the knowledge that we have helped along the good work.

BRIEFLY TOLD.

Secretary Littleton's Neat Notice.—It is a pleasure to receive "copy" from the great, big hearted Secretary of the Western Gas Association; for one does not have to "guess" over it. Knowing what he wants to say, he rounds that knowledge up by "saying" it in words fitting and following in sequence. And with this issue our readers are brought to face with Mr. Littleton's first chapter respecting the 15th annual meeting of an Association, the sessions whereof are always beneficial, entertaining and enjoyable. The arrangements as outlined are evidence of the care with which President Cowdery and the local committee have completed their somewhat, in fact pronouncedly difficult task; and behold the tact that Cowdery displays; he hands the delegates and their friends over to the care of landlord Chittenden—whose handsome and well-kept House is a feature of the progressive city on "the Strait" that, while it "laves" Windsor-in-Canada, it also washes the soil of Wayne county, without harming either—who, when the convention is at end, will be more than ever pleased and satisfied that he is a gas shareholder. Again, the boys are to answer muster in one of the finest armories in the West, hence they may be counted on to put their "best foot forward." Secretary Littleton's hearty acknowledgment of the fealty of those designated to reply to the paper call is characteristic of him, and their fealty is what is to be expected of men whom the spirit of fraternity animates.

The Gas Club of Chicago to go to Joliet—but not to stay there over night, much less for a longer period. With this reassuring remark it may be taken for granted that the visit of The Gas Club of Chicago, to Joliet, which is down for Thursday of this week, will be numerously attended. Joliet, it must be borne in mind, has far more of interest than its famous group of State buildings to recommend it to the attention of the visitor; for here it is that the Illinois Steel Company has reared one of its largest plants. An inspection of these would be all-sufficient to allure the gas man to the city, and when it is remembered that Vice President Elwood, who is the moving genius of the local Gas and Electric Light Company, promises to chaperon and provision the party, why the prospective pleasure is more than doubled. The visitors will leave Chicago at 9 A.M.; and nothing need be said about the return hour. That will arrange itself—there is a fairly good road for pedestrianizing between Joliet and Chicago.

The Market for Gas Securities.

There was hardly any change in the market for city gas shares in the week, save that Mutual was in some demand at higher rates than any recorded in it for years. Equitable was also strong. Consolidated sold off to 110¼, which was the opening price to-day, Friday. Standard, both as to common and preferred is stronger, and the Company seems to be straightening its affairs out at last. Over in Brooklyn no change is reported, other than that the consolidation scheme lessens as to likelihood. It is rumored, however, that a new plan is on foot, which, if carried out, will result in the formation of two companies, one for the Western and one for the Eastern section of the city. There are all the elements of feasibility in this plan. The Fulton-Municipal Company's quarterly dividend of 2 per cent. is payable April 15. Chicago gas is at 76¼ to 76¾, and the stock is undoubtedly a purchase. Baltimore Consolidated is at 53½ to ¼, with a fair chance of a still more marked rise. The general situation is unchanged.

[Official Report—Revised by the Secretary—Continued from Page 478.]

EIGHTH ANNUAL MEETING OF THE OHIO GAS LIGHT ASSOCIATION.

Held at Columbus, O., March 16 and 17, 1892.

First Day—Afternoon Session.

Mr. M. A. Gemuender read his paper on

A BASIS FOR EQUITABLE RATES TO ALL CONSUMERS.

About two years ago, presuming on the strength of 16 years practical experience, I had intended to offer my views on this subject, but other matters drew away my attention and it did not again return until there appeared in print an excellent article on "Meter Rents—A Question of Equity and Policy," by Mr. Walton Clark, read at the last annual meeting of the American Gas Light Association. In this article there are so many points upon which I agree with Mr. Clark, that it seems almost needless for me to say anything at all; nevertheless, I do disagree with him on some minor points, and I moreover think that he takes for granted some things that had better receive more attention. Having entered into this controversy, I will commence in the beginning and independently express myself as fully as time will permit, even though I reach only conclusions that are analogous to Mr. Clark's. If by following a different course my conclusions agree with this gentleman's, why, so much the better for all concerned.

It is pretty generally conceded that the supplying of a city with gas is an interest of the quasi-public kind, and, unless I am very much mistaken, one of Justice Harlan's decisions is very definite upon this point. The following argument is therefore based upon this assumption. As is well known, the courts have decided point blank against the practice of "discrimination" by either public or quasi-public corporations. The Supreme Court of Ohio, in the case of Scofield, Shurmer and Teagle, oil refiners of Cleveland, vs. the Lake Shore and Michigan Southern Railway (Dec. 10, 1885), declared such practices unlawful, and at about the same time, in removing Gen. Phineas Pease from the receivership of the Cleveland and Marietta R. R. for a similar offense, Judge Baxter, of the U. S. Circuit Court, expressed his disapprobation of his course in the severest of terms, designating the letter of Attorney Edward S. Rapallo, of New York, on whose advice Gen. Pease had proceeded, as "impudent" in the extreme. But aside from judicial decrees, it must accord with every one's sense of fairness that whenever a corporation or enterprise is granted any special right or privilege by a community, and particularly when in the granting of which the preferences of a minority are so far sunk in those of the majority that some may be forced to become joint donors even against their own ideas of fitness, then favors to any particular members of the community should only be allowed upon proof positive being given that a rightful claim to preference existed. In the absence of such proof each may reasonably expect to rank on a par with every other associate in the receiving of those benefits that are consequent upon a joint grant.

When now we speak of "discrimination" in the sense of an impropriety, what ought we to mean? Suppose, for example, A and B are creditors of an insolvent estate, both holding claims of the same date, the former for $10,000 and the latter for $5,000, the assets of the estate equaling one-half the liabilities. If the commissioner were to dismiss A, the larger creditor, with a dividend of $5,000, and B with one of $2,500, all would agree that, in spite of the inequality of the sums that were given, the settlement was nevertheless a fair one as between A and B. If, on the contrary, the commissioner was to secretly arrange matters with B so that he was to receive 75 cents on the dollar, while A got but 37½ cents, then, notwithstanding the fact that each was awarded the same sum of $3,750, all would again agree that A had been defrauded and the arrangement between the commissioner and B dishonest. While acknowledging the existence of an obligation on the part of the commissioner to treat all creditors alike, why do we applaud the act which gives A the sum of $5,000 and B the very much smaller one of $2,500, and then censure such conduct as deals out the equal sums of $3,750 to each? The answer is based upon what we understand by treating "all alike." What is the essential difference in these two cases? It is simply this: Our sense of justice demands that each shall be requited in proportion to the service he has rendered; that payments separately bear a definite relation to work performed; the former varying directly as the latter, and utterly regardless of what may be the outcome in the matter of totals; hence, B, who has surrendered double the product, is fairly entitled to twice as large a return as A, whatever in the concrete this may sum up. When now we say "treat all alike," we mean only, give to each that just proportion to which his labors entitle him, but nei-

ther more nor less. It will be at once seen that in the division we condemn that this relation of work and pay has been violated, while in the other instance, that which drew out our approval, it was conformed to.

This brief analysis was given in order to aid in clearing up those confused notions concerning "discrimination" everywhere current, not only in newspapers and on the street, but here in our own meetings. Any observed difference in rates is at once set down as class action, without even a pause to learn whether it is or is not of the blameworthy kind. It is safe to say that unless there is discrimination, that is, a careful distinction drawn between the merits of the various claims pushed forward, and results as accurately as possible, apportioned to deserts, that wrong must be the outcome. If one takes the pains to review the judicial opinions on this subject, it will be recognized that the kind of discrimination that meets disapproval and is declaimed against is of the kind here shown as varying the relation between work and recompense in those individual cases where a strict equality should exist.

From all of this it is to be inferred that when it is once granted that a gas company is a corporation of the quasi-public kind which, for benefits received from a group, as a whole, is to discharge certain duties, then there arises the obligation of dealing with all of its patrons on an equal footing; that is, in order to be just, all charges against a consumer by a company must be strictly in proportion to the amount of service given, and this, by the way, may or may not in practice mean a uniform rate per 1,000. This is also the conclusion Mr. Clark arrives at, and one which I insisted upon five years ago at a meeting of the Ohio Gas Light Association, at Dayton.* "But," it may be interposed, "we know and agree to all this; our real trouble is, how, in practice, are we to apportion charge to service?" "How gauge service and how measure pay?" "What is a workable rule?" This brings us directly to our subject—"A Basis for Equitable Rates to all Consumers."

When it becomes a condition precedent to operation that a corporation or business enterprise shall not bargain separately with each of its customers, and in this manner endeavor to force from them the utmost their individual needs will stand, a right which, by the way, is exercised by all other kinds of merchants, and the acknowledgment of general equality insisted upon, then there falls upon such a handicapped organization the necessity of dealing with all its customers as an *aggregate*, and the problem to solve is, *How divide the burden of cost equitably among the several individuals composing it?* Given the number of customers to supply and the total expense incurred in supplying them, how apportion the expense without unfairness? To solve this problem it will be necessary to carefully analyze the nature of the service rendered.

A company's† make is based upon an estimated *general* demand, and manufacture and storage are consequently only entered upon in bulk, total cost being assessed against total bulk. From which follows that any unit quantity of this make bears equal burden with every other such quantity, or, any two units must be charged with precisely double the cost of the single unit. Supposing, that after manufacture and storage had been completed, each consumer came to the holder and by means of a suitable stop-cock simply drew off the quantity of gas he needed, then equity—equal pay for equal service—would demand that each should pay directly in proportion to the number of units taken away, that is if the unit be a cubic foot, he who draws off 100,000 feet should pay just fifty times as much for his service as he who draws off 2,000 feet, neither more nor less. "But," objects the larger consumer, "is it not generally conceded that the greater the scale upon which business is conducted, up to a certain limit, the lower will be the cost of the unit? And, is it not largely by reason of my greater consumption that the cost of these units has fallen to its present rate? May not I, therefore, justly expect an especial concession?" To this the smaller consumer may reply: "Concession from whom; from me? What grievance am I the cause of? Would you obtain your 100,000 units any cheaper or as cheaply if I withdrew? Such benefit as I receive from your co-operation is not a gain as *against* you, but only an incident. True, you may have, more than any other single consumer, contributed toward a general reduction, but then you forget that at the same time you, more than any one of us, have reaped the benefit of this reduction; whatever figure I may have saved on each of my 5,000 units, you have economized on every one of your 100,000. If you have a large claim on my small benefits, I at the same time have a small claim on your large benefits, for my patronage is also of some value. Assuming that cost diminshed directly as product increased, then if your patronage lowered the cost x per cent., mine would lower it one-twentieth of x per cent., and so your claim of x per cent. of 5,000 units would exactly equal my claim of one-twentieth of x per cent. of your 100,000 units and we are quits." Analysis, so far, shows no valid reason for a special concession to a large consumer.

A company's function, however, does not end, as in the case of a swarm of bees, with manufacture and storage; the consumer does not come after his purchase, but expects it delivered on his premises; and here we enter upon another very important item of service, that of distribution. Gas is delivered by means of underground pipes which have a conveying capacity that varies directly as the squares of their diameters. We are so enabled to send four times as much gas by use of a 4 inch instead of a 2 inch pipe, and at considerably less than four times the cost. This would mean a gain for the large consumer; unfortunately, however, the conveying capacity of pipes also varies, but inversely, as the square roots of their lengths, so that this advantage may be entirely neutralized by a small consumer nearer the generating point.

Generally speaking, the cost of distribution increases with distance, and decreases, up to a certain limit, with quantity carried, but this knowledge is of little avail when we recall to mind that consumers do not arrange themselves at definite distances from a works, in accordance with the amount consumed, but present an extremely purposeless mixture. Besides, a company can not economically run a special main to each customer; a gas plant does not represent a center with definite radiations; in fact long before any particular consumer has been reached, his main has probably been tapped a thousand times for the accommodation of others. Here again, through the exercise of a necessary economy, plans for distribution have been laid out to accommodate, not him individually, but all consumers as an *aggregate*.

We all know that when a new extension is planned, a wise manager, having permanent prosperity in view, does not limit the size of his conduits to the then existing demands, but endeavors to make ample allowance for future additions. Now it is not impossible to calculate and tabulate, in spite of our net work of tubing, from the measured flow to each consumer, just the amount and size of pipe it would require to supply him alone at his distance, but after this had been done in each particular instance, and the results added together, the total would be at considerable variance with the total quantity of pipe in actual existence. How would the discrepancy be disposed of? Bearing now in mind, that in order to charge each with the exact proportion of the cost his demands for delivery entail, that it would be necessary to know just how much of the main was needed to supply him each particular month, then it becomes evident that to determine this, even approximately, would be an utter impossibility, for it would involve the use of an equation composed almost entirely of unknown quantities. So numerous are the difficulties in the way of a specific determination in this direction, that in the apportioning of the cost of delivery there is no choice left a company but to consider its mains and services as but an extension of its storage capacity, and its maintainance, a part of that general expense which is to be assumed equally by each unit of out-put. Again comes the conclusion that as far as manufacture and delivery is concerned, the uniform rate per thousand is the nearest to absolute justice.

These results, however, must not end our investigations; other points are yet to be touched upon. There are services a company furnishes which although definite and constant, yet bear no relation to the quantity of gas consumed, and therefore cannot properly be apportioned with such consumption and must be separately considered. When gas has once been delivered at the place of consumption the functions of the company end, and obligation on the consumer's part begins. For such benefits as he has received he must return an equivalent, and that, too, without further expense or trouble to the creditor. Whatever hardships and inconveniences liquidation of an indebtedness may entail, they must, here as in any other case of debt, be borne by him on whom obligation to square matters rests. When now we remember that the contract between company and consumer is never for the delivery of a definite quality of merchandise, but always implies, instead, a disposition at the convenience of the latter of an indefinite, though ample supply from which he "helps himself" as his needs call for, through outlets over which he demands exclusive control, then clearly it becomes the duty of the consumer to correctly determine the quantity he has abstracted and lift his obligations by going to the company's office and making prompt payment. This is the patron's part of closing a *bona fide* transaction, but to accomplish all this himself would be, in practice, a very difficult if not altogether impossible task, unsatisfactory in its results alike to both parties to the contract and exceedingly wasteful; hence the company is again called upon to furnish its skill and energy in order to correct deficiencies. For such additional services the company may rightfully claim further remuneration.

*See JOURNAL, No. 168, p. 249.

† The word "company" is used because of convenience.

As this service, the adjusting and aiding in the settlement of a customer's indebtedness, is the same for each individual regardless of the amount of his patronage it therefore becomes a fit item for separate treatment. Meters are furnished and removed at a consumer's option, they are read for him, amounts of indebtedness calculated, memoranda are presented, suitable and convenient offices are provided for his accommodation and he is again notified when delinquent. Besides these, there are other labors such as keeping free his own service pipes, making tests, special rereadings, etc. The total cost of these items a company can easily compute, either monthly, quarterly or yearly, as may be deemed proper, and divide equally among its patrons as a service (labor) charge, not, however, grouping the various charges under the name of "meter rent" as has been suggested. This charge would be a simple and steady item which would not needlessly encumber the company's books or statements, and what is more important still, it would remove an expense now charged against the cost of gas itself and make possible a reduction in the general rate.

On the subject of meter rent, it may be said that policy suggests the entire abolition of this time-honored charge, not because of any injustice involved, but for other reasons that will be given. In the first place it is an extremely unpopular item, and so much so that the Legislature of our State took it upon itself to intefere, providing—

"No gas company shall have the right to charge rent for meters when 500 cubic feet per month have been consumed."

Later the Statutes as revised and adopted in 1880, declare—

Sec. 3558. "No gas company shall have the right to charge rent for meters."

But in the very next section we have—

Sec. 3559. "If any person so supplied with gas neglect or refuse to pay the amount due for the same, or for the *rent of the meter*, or other articles hired by him of the company, the company may stop the gas from entering the premises of such person."

These sections seem to contradict one another, but nevertheless their hostile bearing upon the question is plain enough. If meter rents are to be collected, they should be charged, based on size of apparatus, uniformly on every bill regardless of gas charges. This of course, in Ohio, would be impossible without a change being brought about in the existing laws. Besides unpopularity—a rental for a meter is objectionable because it is unnecessary. With such few exceptions as will appear later the size of meters is fairly proportioned to the amount of gas used as the following calculation will show.

Distributing the entire cost of a meter over a period of ten years, which is about its average life, add on a charge for interest, and you will have the cost of meter service. It ranges about as follows per month—

3 Light.	5 Light.	10 Light.	20 Light.	30 Light.	60 Light.	100 Light.
$0.066	.084	.106	.146	.20	.40	.666

A calculated maximum monthly capacity for the above period gives in feet—

3 Light.	5 Light.	10 Light.	20 Light.	30 Light.	60 Light.	100 Light.
3,000	4,500	7,300	14,600	21,900	43,800	73,800

This gives a cost per 1,000 feet measured—

$0.023	.018	.014	.01	.01	.01	.01

From these figures it becomes evident that the cost of measuring bears a fairly steady relation to the quantity of gas measured. Such variations from this standard as would take place in practice would be but a very small per cent. of the entire bill, and would in all probability be more than swallowed up by the other inequalities that can not be done away with. A charge for a meter is not an unjust charge, for a company may divide and subdivide its services into the minutest details and make a separate charge for each, but if all such particular services have a general characteristic that permits them to be gathered into one item, then it is economy to so group them. As the cost of furnishing and maintaining measuring apparatus bears a relation to the quantity of merchandise measured, there is no reason why it should receive particular attention any more than we make separate charges for individual service pipes including all those innumerable dead ones which were ordered extended to private property, some across narrow alleys, others across wide streets, only to be abandoned and left on the company's hands whenever caprice or necessity prompted. Here, as in all other charges for service, a company can only make a uniform division of cost among its patrons upon fair general principles. If it were attempted to go beyond this and mete out to each no more than his actual share, the labor necessary for determining just what that share is would far more than eat up a possible saving. Under such conditions there is no injustice done when the meter investment, like that in main pipe, is taken as a part of the general plant and divided pro rata among consumers.

To the equitable working of this rule, however, there may appear to be some exceptions, but examination will show that these exceptions are not material. Since the advent of electric lighting there have arisen numerous instances in which large meters have been retained, not because of relations between company and consumer, but merely as a matter of convenience and safety for guarding against the unreliability of the new light. Then there are other cases of which Mr. Clark gives a fair example—the church that retains a 100-light meter to measure a spasmodic consumption of 3,000 feet per month, while a householder next door uses an equal quantity of gas through a 3-light. In such cases the following method may correct these inequalities.

No company can, in justice either to itself or to its consumers, be called upon to furnish a meter larger than is necessary to measure an average flow for a general average unit of time, and it may properly insist upon maintaining a relation between the quantity sold and the apparatus needed for determining supply. Hence, when a consumer wishes, for his own convenience, to disturb this relation, he must expect to pay for the privilege. Therefore, transfer to him the ownership of the meter at a fixed rate, making such allowance as equity demands. For example, sell the chuch a 100-light meter, and if a 3 light be large enough to supply its average use make them a further discount on the price, equal to the cost of a 3-light, to which they would be entitled; but this latter only upon condition that the meter so obtained is to be used as an outlet for the company's gas. When the church ceases to be a consumer, or should it return permanently to general and normal consumption, buy back the meter, if still serviceable, making a proper deduction for wear and tear. This arrangement would fairly and practically settle inequalities in the meter question, and allow it otherwise to be set entirely to one side.

Returning to the general "service (labor) charges" here suggested, it may be stated that it would, on a rough estimate, not exceed 25 cents per consumer per month. Some might, by reason of smallness, deem it a "petty" charge that had better be discarded altogether, but a little reflection will probably show the need of its retention. In the first place, it serves a purpose now fulfilled by the meter rent charge—namely, it enforces economy, by urging the prompt notification of the company when there is no further need of its services, and useless outlay of labor and capital is at once stopped. Meters, by reason of this expense, will not be retained when not needed. Again, is it in fact a "petty" charge? During the month of September, which is about an average month, here in Columbus 13 per cent. of the bills were for 30 cents and less, and 40 per cent. did not exceed $1 in amount, while but 45 per cent. were larger than $1.50. What does this mean? Only this—a charge no larger than 15 cents means an increase of from 10 to 150 per cent. on a majority of the consumers' bills; and 25 cents would mean 16 to 250 per cent. increase where the rate is $1 per 1,000 feet. If consumers should number 6,000, the company would be in receipt of $900 to $1,500 monthly—surely no insignificant sum, and which income, placed to the credit of gas making, would make itself felt in rates.

We have now arrived at a solution of our problem—"a basis for equitable rates to all consumers." As here conceived it is a reduction of cost to a proper unit of service, which means in practice a uniform rate per thousand, plus a universal and uniform service charge.

Before leaving this subject, however, a few practical deductions may be made from the principle of general equality. If equity asserts that a company may demand only uniform recompense for each unit of work performed, it follows as a matter of course that not only those graded and sliding scales of rates are wrong, but also a strong suspicion arises that even concessions for stove and engine uses, aside from merely temporary experimental purposes, are not above question. As this latter point is one of importance, a brief analysis may be of service.

It is generally assumed that as a large part of a gas plant is practically idle during daylight, any use to which it can be put during this time represents so much of clear gain. The supplying of day service entailing no extra outlay of capital for extension, it is concluded that day consumption costs less than night consumption, and consequently a reduction may justly be made for day uses. What is the fallacy in such reasoning? Suppose a tinner is engaged in making fruit cans, and needs additional help. His extra work, however, is not sufficient in quantity to take up more than half the new man's time. Nevertheless, as he could not hire a competent man by the half day, he is compelled to take him on full pay and charge the same against his fruit cans. Presently there arises an unexpected demand for tin cups. The employer at once makes use of the spare time by setting the man at

work in the new field. Here is a net gain of one-half the employee's time; how does the employer figure? Does he reason that because of this gain tin cups cost him almost nothing? Were someone to steal them, would he not demand and the courts grant him relief against the thief for the full proportion of the time their making required, and deem such their real cost? Suppose, further, that competition would demand a lower rate on fruit cans; could he not properly remove, if not already done, a proportionate charge of cost from the fruit cans, add it to the tin cups, and still show a profit? Is it not a fact that these tin cups cost all the energy it took to produce them, and that their production offered an additional profit, not because they sold at a margin, which is questionable, but by reason of a burden taken from the cost of fruit cans? That is, the new gain is but a reduced former loss.

And so it stands in the matter of gas supply. Necessity demands in the construction of a plant that it shall be sufficiently large to meet at all times a maximum call. This demand we all know is not uniform, but periodic. During intervals of disuse the capital invested is unproductive, and there arises a waste. But who pays for this waste? None other than the night consumer, whose rate per 1,000 is based upon total expense, waste included. The moment this waste is utilized the labor and capital involved at once become productive, and should therefore become a charge—an item of cost—against the beneficiary, and there should be a corresponding credit to that account which previously bore the burden. It is only possible to hold that day supply costs less than night supply when it is deemed right to persist in charging a loss against one account which has been removed by benefit to another account.

Should the day consumption so increase as to finally equal the night use, would it still be fair to heap up a charge for dead capital against one class which was in fact performing active service for another? Is the case varied in the least when, instead of a complete saving, there has been but a partial reclamation? "But," it may be objected, "granted that night consumption is charged with a waste, does not its recall, at whatever price it may bring, redound to the benefit of all? Did not the making of tin cups make possible a lower rate for fruit cans in proportion to receipts, large or small?" True; but there is here neglected a vital point. The relation that purchasers of tinware bear to the tinsmith is not at all the one that is assumed to exist between a gas company and its customers. Whereas a tinsmith is at liberty to shift his cost among his patrons in any way that may profit him, in the latter case there is but one customer, an aggregate which insists that if there are to be benefits they must incur no sacrifice, and fall equally or not at all. It should never be lost to mind that a company is not in a position to determine how much it may do for each patron on an independent deal; but, as before stated, the problem is, how divide equitably among all a necessary outlay? As a company may not of itself stipulate as to what uses its merchandise may be put after it has passed from its hands, it becomes the concern only of the purchaser, how it shall be disposed of. A company's service retains the same character, changing its nature not in the least, whether the gas furnished is consumed for light, heat or power, and hence, so far as charge for work is concerned, there is no ground whatever for variation on the company's part.

Doubtless, to many it will appear that here is a conflict between principle and common sense. It must seem extremely foolish to sit still and allow a waste to go on which it might be possible to make serviceable, and for no other reason than that pushed forward on the grounds of general equality. It may be asked: "If it be deemed wise to reap benefits from our residuals, such as coke, tar, and ammonia, is it not equally good policy to rescue waste capital along with waste material, and especially when no one is actually damaged thereby?" To which may be replied that while it is insisted that a company in conformance with an obligation may not of itself recognize any distinction between the demands of its individual patrons, yet there is no wrong done when the aggregate itself sanctions a departure from strict impartiality, which is to say that if when a general agreement between consumers as a whole and a company is entered into, it is the desire of the former to reclaim waste after the manner proposed, then the obligation on the part of the company is correspondingly modified, and it may rightfully proceed with such discriminations as this saving necessitates. But the task of securing fair treatment for each is thereby only shifted from the company's shoulders upon those of the accredited agents of the community, and it devolves upon them to justify a discrimination in the following manner: First, they must show that there is a material and chronic waste, and second, that the assistance of the favored class from whom aid is expected is only to be obtained by means of a special discount. This latter, in the opinion of the writer, it is impossible to prove, and to make this clear it will again be necessary to offer a brief analysis.

What is this waste, in nature and extent? The works proper are never resting, they are in active service day and night. The only idle capital lies in the distributing apparatus, mainly between the hours of sunrise and sunset. What now is the actual loss? A rough estimate may be made by a comparison between the charges of natural and artificial gas companies. In Columbus the former collects 20 cents and the latter $1.00 per M., and the 80 cents difference, or four-fifths of the cost, may, therefore, fairly be charged to gas production. Were it possible for the natural gas company, whose outlay is mainly distribution, to obtain a double service from its mains, then the utmost saving would not exceed 10 cents per M., and probably be in fact far less, as many other expenses would not remain constant.

But remaining with our own process, what is to be found? Take a plant with an actual capital of $1,000,000.00, and an output of 200,000,000 feet, at $1.10 per M. Assume, as is generally the case, that the capital invested in the distribution department is one-half of the whole, or $500,000.00. Then again assume that this part of the plant is entirely idle for 12 hours of daylight, a supposition which, by the way, is far from true, then the utmost lost is the interest on one-half of this capital, which at 6 per cent. would equal $15,000.00. The total cost of the gas to night consumers would be, at $1.10, $220,000.00. If we substract the $15,000.00 from this sum we will get what would be the cost but for the day waste; it equals $205,000.00, or $1.02½ per M., that is, a saving of 7½ cts. per. M. This $1.02½ represents a new unit of charge below which it is impossible to go without inflicting direct injury on the night consumer. But to grant the full discount of 7½ cents to the day patron would offer no benefit whatever to him who grants it; he too would probably like some share of the saving, or he would not be interested in bringing it about, so that these 7½ cents may be scaled down to less than 5 cents.

What is to be inferred from this? First, that the waste is not so great as is generally supposed; and second, that it would be exceedingly difficult to show—as was demanded in requirement No. 2—that a desired assistance could not be obtained without a special discount; for surely the matter of 5 or 6 cents, or about 5 per cent., would, to use a common expression, "cut no figure" at all in practice, whether or no gas could be used profitably for other than illuminating purposes. So meager are the arguments that can be put forward in behalf of special concessions to day consumption, that a tender of payment on the part of a hotel keeper who consumes 200,000 feet during night time, at a rate no larger than that granted a printer who consumes but 20,000 feet in an engine during daylight, would have to be respected, and, in the opinion of the writer, a refusal of such a tender would receive the reprimand of the courts as unjust discrimination.

In laying plans for conduct towards the public, a company should ever aim at reaching permanent conditions, and leave aside as much as possible such acts as offer a temporary advantage, but at a sacrifice of principle. As there can be no durable arrangements unless the conditions that govern stability are known, it has been the object in this paper to show that if there is to be unhindered continuance in business pursuits there must be no acts on the company's part that can be characterized as unjust; and following in this line in order to obtain a practical basis for equitable dealings, an attempt was made to reduce a company's operations to a correct unit of work performed, which was to form a measure for the exchange of services in all transactions. If in this attempt the reasoning should prove faulty, then it becomes the task of others to apply proper corrections, but upon the necessity of the adoption of such a unit, and its unvarying application, it is strenuously insisted. In spite of the objection that has been raised that "Scientific nicety, mechanical principles and algebraic formulæ can be employed advantageously by the constructing engineer, but they can hardly aid the manager of a gas company's business in his endeavors to improve upon the policy of the company in its relations to its consumers," in spite of this reasoning, unless it is to be granted that a manager's course should be "unprincipled," then it must be evident that there ought to be a definite foundation underlying any policy whatever, which is to serve as a guide for management. If such fundamental principles can be formulated with algebraic nicety, so much the better, for the less chance will there be for that floundering about which always accompanies actions that are dictated by mere expediency, and are annoying alike to all parties concerned.

Much, if not all the contention in railroad circles regarding "long hauls" and "short hauls," also many of the questionable court decisions concerning discriminations are directly traceable to loose determinations and classifications of the various items of cost, and this irritation must continue until its cause is removed. If the foregoing arguments have not brought out a correct formula for regulating and

governing relations between a company and its consumers, then the sooner some one else accomplishes this task the better.

Discussion.

The President—Gentlemen, you have just heard read a most carefully prepared and interesting paper—a gem worthy of the most thorough discussion, and which, no doubt, cost the author much thought and arduous labor. I hope you will "lay the bones bare" and make the discussion thorough and interesting.

Mr. Padan—Mr. Gemuender has given some strong arguments in favor of equitable rates. I think, theoretically, he is correct. I have followed his paper pretty carefully, and from a literary standpoint the paper is a gem. It reads as beautifully as the "Golden Rule," and I think it would be about as hard to execute (laughter). I think his sentiments pretty high. They are particularly well adapted to companies having no local competition. I would like to ask him if he would advise a gas company to refuse to deal with a buyer as an individual.

Mr. Gemuender—In accordance with the "Golden Rule" I would advise you to do right.

Mr. Faben—I can only indorse the sentiment expressed by Mr. Padan. The "Golden Rule" is very happily brought in. The reason I have not been a thorough convert to a uniform rate rigidly enforced is because we don't find a uniform rate advisable at this time. To follow the principles laid down in the paper would, it seems to me, amount to an education; and life is almost too short to educate a community in the beautiful principles therein expressed. There ought, I think, be some more direct relation between the value of service rendered and the price charged. I noticed one statement in the paper, which I think is a little misleading—in regard to charging meter rent. The statement that the law says that a gas company shall have no right to charge for rent of meter is correct; but the section next following that, referring to rent of meters, does not at all conflict with the preceding one, because in an earlier statute relating to gas companies (I think Section 2,478, R. S.), it is made mandatory for a town council to fix the price that gas companies may charge, or shall charge for meter rent, and that price is the maximum price. They cannot charge more than that, but there is nothing to prevent them from charging less. The last part of the section reads: "And such Council shall also have power to regulate and fix the price which such companies shall charge for rent of their meters."

Mr. Gemuender—I may be able to throw some light upon that point. The law says distinctly that you cannot charge for meters. You cannot make any contract by authority of a city council which is directly contrary to the State law. There is no doubt about that, but I think the whole trouble arises from a mistake. The first laws enacted upon this subject qualified that language by putting in the 500 feet limit; but, in 1879, I think when the laws were codified, in a mistake that qualifying clause was left out, and the statute remained just as I have quoted it here, that no company shall have a right to charge rent for its meters.

Mr. McMillin—You mean that they made an "unintentional" mistake?

Mr. Gemuender—Yes, sir.

Mr. McMillin—They make lots of "intentional" ones.

Mr. Faben—I think if Mr. Gemuender will look that matter up again he will find that the law where gas companies are not to charge rent for meters is under the heading, "Gas and Water Companies," and it says that no gas company nor water works company shall have a rental charge for meters. That is in section thirty-five hundred and something, isn't it?

Mr. Gemuender—Yes, sir.

Mr. Faben—But Section 2478 is the first section of the Revised Statutes pertaining to gas and coke companies. Gas companies are incorporated in the same category now as the electric lighting companies. In Ohio, in the absense of an ordinance granting companies the right to make a charge for meter rent, they are guilty of an infraction of the law when they do make a charge.

Mr. Gemuender—I don't mean to insist that rent for meters cannot be charged, but I have quoted these sections to show that there is a feeling against the charging of meter rent; that is all.

Mr. Graeff—Mr. President, I think Mr. Gemuender certainly deserves the commendation of the entire fraternity, and especially of this Association, for his paper. He has presented a paper which shows careful thought and great research. I believe, with Mr. Padan, that it is a good deal like the Golden Rule, but I think that, whether it is hard for us to follow it out or not, the time is coming when we have got to educate our patrons on this subject. President White, at the October meeting of the American Association said, in a very neat little speech, that the time of the "rule of thumb" had gone by; and I think it is. The time is coming when we have got to consider a great many matters in our dealings with the public, both as a general public and as individual customers, which we would not have thought of some few years ago. Some of us can remember the time when all that the coal gas engineer needed to know was, that if he charged coal into a retort, the holder went up; and I can remember very distinctly when water gas was made like Daniel Boone played the flute—"by main strength" (laughter). There was not much calculation in it; but we have got to face the music and have got to consider matters of equity and questions of economy. You may laugh at Bellamy and think his writings impracticable, but there is considerable method in his madness, and no matter how theoretical it may seem, yet, the lion is going around—the economy lion is certainly loose, and he is going to devour a great many in his path before he satisfies his hunger. I believe, with Mr. Gemuender, in charging a uniform price, as I understand it, but I don't exactly agree with him as to the uniform service charge. I think in that respect he differs from Mr. Clark. I don't propose to be catechised because I am not a philosopher, but I rather think that the meter-charge should be made more upon a basis that I understand Mr. Clark to advocate. I may be wrong in assuming more difference between the two than there really is. As regards one point about which he speaks, unless he has made a mistake there are a good many consumers in this city who won't use 6 cents worth of gas a month, and I think a pretty good service charge should be collected from such consumers. Mr. Gemuender says, "A charge no larger than 15 cents, means an increase of from 10 to 150 per cent. on the majority of consumers' bills." He may be correct in those figures, but I think for a consumer who only uses 6 cents worth of gas a month there should be a pretty stiff service charge. I confess I would like to have elaborated this idea of the tin-smith. I don't exactly understand it, and I would like for Mr. Gemuender to explain this a little further. Unless the rest of the members are brighter than I am.

Mr. McCook—They are. (Laughter.)

Mr. Graeff—Mr. President, I might have known that, because the "tin" question is the favorite question in Ohio. I had forgotten that (laughter), and if these tin cups which Mr. Gemuender speaks about are made of American tin, I will beg pardon and say, "God bless the tinsmith." (Laughter and applause.) There is one question upon which I must differ from the author, whether I am right or wrong, and that is upon the question of not making a difference in charges for gas for fuel and power. I cannot see the equity of Mr. Gemuender's statement. Perhaps the matter of policy comes into my mind, because, while at the present time it would be no doubt easy to prove that you could not get this consumption without making some special concession, yet I see Mr. Gemuender is aiming at a time when that would be hard to prove; but I still believe in selling gas for fuel and power purposes at low rates. And in regard to this question of disposing of large meters—selling a 100-light meter to a church—my experience, limited both as a church official and as a gas official, has been that churches, with all due respect to my friend Dr. McFadden, are no more liberal in the purchase of such materials as a meter would be included among, than they are in their catechism; and I think that proposition, on that account, is impracticable, not only as concerns a church, but as concerns a great many consumers who need gas occasionally. In a large city there are a great many of that character, and I doubt whether they can be induced to purchase a meter upon the specification that the gas company would buy the meter back if they ever concluded to abandon the use of gas. I think the service charge, or the charge for such items as Mr. Clark included under the head of "meter rent," is a far more equitable way of procedure. And, by the way, this term "meter rent" conveys an accurate meaning; but the idea has gotten to be too general, I think, from the different remarks that have been made. I think the expression "meter rent" bears too directly upon the charge for meter. As I understand Mr. Clark, and as I think we all really understand him, it includes every charge to be made, simply grouped under this as a designating term. I think Mr. Gemuender's term of "service charge" is a much better one. The paper certainly admits of considerable discussion, and I trust it will get it.

Mr. Chollar—For many years I thought over this question a good deal, and I have not been able to clearly see any good reason why a gas company should make more than one rate. It is a question evidently that has two sides, and very strong reasons and strong arguments on both sides; but I have not been able to clear my mind of the fact that gas companies are organized in their business to supply gas, and any amount of analysis on this question ends in a fog bank. The question

is not what we would like to do, or what we would be willing to do, but is, "What can we do?" Now, it seems to me the end of it will be that a rate must be made for the large consumer, and the little people get the advantage of it. It seems to me that that is the solution of the problem. It is difficult to make a parallel case in business—for instance, the distribution of gas as compared to the freight business or the hauling business. A more fair comparison would be the passenger business. Railroad companies cannot carry a little man any cheaper than they can carry a big man. The rate is the same in all passenger traffic; and so with gas, the rate must be made for the large consumer of gas, for the bulk of the gas, and the little fellows get the advantage. As the Scotchman said, "Many a mickle makes a muckle." We want the aggregation of consumers to make up the difference. While the business taken separately may amount to a little, yet the aggregation of all that small business is just what we want, as well as the big consumers. It would seem to me the object of our work should be to get the little ones, because we can get the big ones much more easily, but not so many of them; and then the big consumers must control the rate.

Mr. McMillin—I followed Mr. Gemuender's paper with a great deal of interest. His arguments I thought were all very good. They were all so plausible that I found myself being confronted with both sides of the question. When he took up the argument in favor of it he converted me, and when he got on the other side, he converted me to that side of the question, so that I am somewhat at a loss to know just where I do stand now. I would say, however, that as a matter of protection to gas companies, I believe it is almost necessary to have a meter rent charge, or something similar to that, and that is one of the ways of doing it. I have some question as to whether the statute would prohibit a gas company from contracting with its consumers under which contract the consumer has agreed that if he does not burn gas enough to make a charge, he would pay meter rent; I do not think there is any infraction of the law. Assuming now, for the sake of argument, that the gas companies in Ohio are prohibited from making a meter charge, we certainly must give every man gas that applies for it; if he wants a service pipe run, we must run it for him. Consequently his property, which stands on the line of the sidewalk, is supplied with gas, and service pipe is put in practically all at your own expense. He has the meter set, he has the property wired for electric light; but for fear that the electric light may go out at some time, he wants his gas meter there and the gas turned on. He may be a lawyer or other professional man, who don't go to his office very often in the evening, but it is nice for him to know that if he does go there he can light the gas. Now, the company has an investment there of anywhere from $10 to $50 for his accommodation, and the question presents itself, "How is the company to secure any return for that investment unless it charges a meter rent?" The quantity of gas he burns is not enough to make a charge for. Perhaps in the course of a year he might burn 100 feet or so of gas, and for that this company would get 10 cents. His service pipe has probably leaked 25 cents worth of gas in that time. I do believe in a uniform charge for gas; I do believe in uniform rules of every character and kind, about a gas plant. I don't always get my associates to agree with me about these things, but I believe in drawing the line pretty rigidly. I have a rule that if a new territory asks for a pipe to be run, it shall give us a consumer for every 100 ft. Any other number may be agreed upon, but the rule ought to be definite. If some one wants me to run a line 1,000 ft., and he can convince me that 10 consumers are at the end of it, I will run it. If they cannot secure but nine consumers I will not run it, unless they pay a proportion of the expense. Then I have rules like this: If it is in a neighborhood where some company or organization has laid out an addition in the suburbs and wants to improve the street before-hand, and it is perfectly clear that they are going to have a good class of consumers and plenty of them there, if they will pay one-half of the expense we will pay the other half, and put the pipe in before the streets are made, and then it is all our own. Or they may pay all of the expense, and everytime they get a consumer after the pipe is in and the gas delivered, we will refund a portion of what they paid for the pipe. If 100 feet of it costs $100, then the parties get $100 back for every consumer obtained. The same with our discount system. I do not know what the clerks or secretaries may do, but certainly I never have and never will allow a man a discount, if he does not come in and pay on time. I do not care what his excuse is, if you offer him the discount within a certain time and he does not pay it within that time, he is not entitled to it. There may be cases where there would seem to be a hardship, but if you want to have peace, or the nearest approach to it, treat all alike; if you allow Smith his discount after the discount day has gone by, Jones is entitled to it, and Jones will certainly assert his rights. Mr. Gemuender had supposed the case of a tender of payment by a hotel keeper, who consumes 200,000 feet during the night time at a rate not larger than that granted a printer who consumes but 20,000 feet in an engine during day-light, and says he could probably enforce his right to have his gas at that price. I only know of one instance of that kind having been determined by the courts. I think it was in the Circuit Court of the United States, and that court did not sustain Mr. Gemuender's view of it. The case was in Baltimore. The gas companies at that time I think, were generally selling gas at a $1 a 1,000; they were on some streets selling it at 35 cents, where there was competition and a bitter fight, and the parties tendered their 35 cents in payment of the gas consumed, which was refused by the company and the gas was turned off. This case was brought into court in some shape or another, and the court decided that $1 was a fair price, and that if the company did not charge as a matter of fact more than a fair price, they had a right to give Jones his gas for 35 cents if they chose. Now, with all due respect to the eminent justice rendering the decision, I believe the courts ought to rule as Mr. Gemuender has said they would rule, that if a company could afford to sell at 35 cents, or could afford to give it away, this was evidence that they were charging the other consumer too much, and it should have been stopped. We all have a right to give away our property if we want to, but if we do it in a business way, under public franchise—if we sell to one class of people at a lower figure—it is evidence that we could make a slight reduction to all of them, if we charged all alike; so that I am heartily in favor of uniform rates and uniform rules, and of a charge in the shape of meter rent, or some other form, to all consumers who do not burn a sufficient quantity of gas to be charged for.

Mr. Hayward—I would probably have to beg the pardon of this Association for entering into this discussion on "uniform rates," from the fact that I neither make nor sell gas; but as an outsider, and being interested in this matter, I beg leave to differ with the gentlemen who have just spoken and with the gentleman who read the very able paper. As this paper has been quite lengthy and the discussion long, and as there are other papers to be read, it is necessary that I should be as brief as possible. I want to state my reasons for the position which I take on this subject. There was a time in the business of making and selling gas, when the manufacturer could produce almost any kind of gas and tell the community, "You can take our gas or let it alone." I think that day is past. There are certain laws and rules in regard to the business; but there are also laws of nature and of grace which cannot be violated. It is a law well known and laid down that "To him that hath shall be given, and from him that hath not shall be taken away, even that which he hath." Getting down to the practical thought, we know that the rich man buys his flour much cheaper than the poor man. There are certain laws of trade under which the poor man's bread and butter cost him more than that of the rich man, and the man who goes to the small store to buy his little pittance has to pay more for it because he has to buy it in small quantities; and so in regard to other things. For instance, I may sell iron sponge and I have to charge more for it when I sell it by the barrel than I do when I sell it by the car load, because I have to pay more proportionately for hauling a small quantity than I do for a large quantity. Suppose you have a large prospective consumer of gas and wish to secure him as a customer; you make your rate to him. When it comes to the practical part of the work—the cost of keeping that man's accounts and the cost of collecting, as well as other items of expense, justify you in making a concession to him. There is the matter of bookkeeping, the reading of his meter and its examination. It costs just as much to do this for the little man as for the one to whom you sell 200,000 feet of gas per month. You are anxious to secure that man's custom, because you can make more money out of him than you can out of the small consumer. So, I say, it is a matter of policy. You cannot lay down these rigid rules in regard to it, but you must follow out the same policy in regard to getting and retaining your business that is exercised in getting trade in other classes of business, especially in these days of competition. Another question that I want to bring into this discussion is the selling of gas to day consumers—people who use gas stoves and gas engines. Unless you can sell them at a reduced rate you are not going to secure them as customers, and there again comes in the question of policy. You say to such, "If you put in a gas engine and consume a certain amount of gas, I can afford to sell it to you for less;" otherwise the man will not be able to use the gas.

Mr. McMillin—Suppose you are selling gas throughout the city at $1.25 to the ordinary consumer; you would think it fair, then, would you, to sell a gas engine man his gas at $1?

Mr. Hayward—It is a question of policy, and you do it in order to get that man's custom.

Mr. McMillin—You want to get him even at that much reduction?

Mr. Hayward—Yes, sir.

Mr. McMillin—Now, suppose you sell to all consumers at $1, then would that man be still entitled to a further reduction?

Mr. Hayward—Not unless you could afford it.

Mr. McMillin—Then you have a uniform rate.

Mr. Hayward—I am talking now about securing trade. How are you going to do it? It is a question of policy—it is a question of getting trade; and that is my position. In this day and age of the world, the time has gone by when gas men can take the grand and lofty position which they once assumed. I feel it cannot be done and make a success in the management of the gas business.

Mr. Gemuender—Suppose you should do as you suggest, and the court would then remove you and appoint a receiver, because of your unjust discrimination in rates, then what would you do?

Mr. Hayward—Simply have to bow to the orders of the court; that is all there is of it.

Mr. Gemuender—In my whole paper I have assumed a certain condition and state of affairs. The supposition is you are obligated to treat all alike. I have tried to reduce down to something definite what is meant when you say "treat all alike." I have also tried to bring out a correct and practical unit. If I have failed, then some one else can point out wherein I have erred. I have given reasons all the way through for my conclusions, but I have reasoned from a certain condition.

Mr. Hayward—Certainly, if the law says you must sell gas at uniform prices, you must bow to the law; but I say there is a law of trade by which we don't sell goods at uniform rates. A man who buys 5 pounds of flour has to pay more for it than one who buys a barrel of flour; that is the law of trade, and there is no getting around it.

Mr. Humphreys—One word on this subject, in regard to the last statement. I understand Mr. Gemuender and Mr. Clark to have started out to show, in the first place, the difference that could be properly charged against different ways of selling, and to determine wherein is the variation in cost. You may call it what you like, but after that difference is adjusted then they advocate that gas should be sold on a uniform basis. Now, the rule of wholesaling as it applies to ordinary business at large cannot be applied to the gas business. We have to establish our own wholesaling laws, and it is as I understand it, in an effort to establish that law properly by analysis, that these gentlemen have been engaged. I think that would answer Mr. Hayward's point. It would to my mind. As I understand Mr. Clark, in using what he calls "meter rent" he took a somewhat unpopular name. I think it was a mistake to call it so; but he took that as the name by which he was going to bring about this equalization in charges. Mr. Gemuender arrived at it from a different course of reasoning. With regard to the theory and practice, I do not think we should start out by saying that, because it is a theoretical consideration of the subject, it is not worthy of our consideration as practical business men. If we are to establish proper rules to govern us in the business, we must first find out what is the Golden Rule, and then live up to it, just as closely as the prejudice of the people will allow. To do that we have got to analyze the different conditions and adjust the differences. Mr. Gemuender has certainly made a very able effort in that direction. Mr. Clark has done it from a different direction. I don't quite agree with either on some points, but in the main I certainly do. Speaking again of the practical side of it, we of course have to bear in mind the nature of the subject we are dealing with, and also the prejudices of the people. And we have got to bring our requirements, to a certain extent, in conformity with those prejudices. The people have got to be educated; our education cannot run too far ahead of theirs. On page 4 of the paper under discussion is the statement, "Supposing that, after manufacture and storage had been completed, each consumer came to the holder, and, by means of a suitable stop-cock, simply drew off the quantity of gas he needed"—the point is there made that there would then be no ground for a differential rate. I don't quite agree with Mr. Gemuender when he makes that statement, because I think there would still be a difference in different consumers, as to size of bills, etc. On the question of "office charges," if one man came and withdrew 500 feet, and another man came and withdrew 500,000 feet, it would be easier to make out the bills and keep the accounts, if the consumer took 500,000 feet than if that aggregate amount were made up by a lot of little consumers, taking smaller amounts; and that same idea would be carried all through the books and accounts. Of course, that is a fine point.

Mr. Gemuender—If you will take notice, I mean he would *owe*. I did not imply a collection. I mean that each would *owe* in proportion to what he took.

Mr. Humphreys—Yes; but I understood the paper to endeavor to show that you would only collect in proportion to the amount consumed.

Mr. Gemuender—I had not reached the point of "collection." I said that each *should pay* in proportion to what he took.

Mr. Humphreys—On page 8, in regard to the size of meters, and the charge that would be placed against the consumer on that account, I don't agree with Mr. Gemuender, because I think it presupposes that the meters will be used to their full capacity. Of course we know that is not done. We all have very many customers who insist upon having meters of capacity away beyond that which we know they will require; and in illustrating this argument, by referring to the church, Mr. Clark took an extreme case. We all know, coming down from that extreme case to regular, practical business, that there are any number of cases where the same point applies. On page 9 the remark is made that these exceptions are not very material. I think they are very material, and have to be carefully taken into consideration if you are going to make a uniform charge. On the same page we have a case given of selling a 100-light meter to a church. I would raise my voice in warning as to the practical question of any company selling its meters to any consumer. We had one case—not of our own—which I might refer to in this connection, where we bought a company's property, and the company owned one-third of the meters, the other two-thirds being owned by the consumers. There was no end of trouble, and we had finally to buy every meter. I think we have a few instances where the consumer absolutely refuses to sell his meter, and we are just waiting for the old meters to play out so that we may replace them with new ones. If we are going to sell gas through an instrument which is to measure the cost of it, that instrument ought to be in our hands to keep in repair, etc. I don't agree with the author that there should be a universal and uniform service charge. That expression may not fully convey exactly what Mr. Gemuender had in mind—"a universal and uniform service charge." How a uniform charge is going to take up this difference of course I cannot see. It must vary in some way according to the conditions of consumption. One other point. When we come to analyze just where the difference comes in, I don't think we can assume that the difference is clearly applicable to the distribution department. Take, for instance, the case of estimating on the cost of works to produce a certain amount of gas per day; think for a moment what would be the difference in the cost of those works if you could, say, instead of sending out your gas during a few hours out of the 24, distribute it equally through the whole 24 hours. There would be a very large difference in the cost of the works, especially in regard to the holders in the case of coal gas, or in the generators in the case of water gas. You will find, when you come to figure on it, that it makes a very large difference in the first cost.

Mr. McMillin—A little incident occurred in the history of the Columbus Gas Company that I feel I ought to relate here, even if I take up two or three minutes of your time in so doing. The laws of Ohio, many years ago, permitted charges for meter rent of, say, 5 or 10, or probably 25 cents, and for large meters probably 50 cents; and a gentleman—a very estimable gentleman—living in this city at that time, concluded that as he had the spare change he would like to buy his own meter, and the gas company procured it for him at a cost of $15. Very shortly after he purchased his meter they abolished their charge of 50 cents, or whatever it was, for meter rent; but he did not find this out until about 4½ years thereafter, and then he came to the gas company and asked them to buy the meter back at $15. The then Secretary and Treasurer declined to do that. He probably did not care to buy it back at all, but he certainly did not care to pay that price for it. The gentleman then figured out that at 50 cents per month, the price the gas company had established for that sized meter, it would be $6 a year, and as he had had his meter in use for 4½ years he brought suit against the company for $27, and got judgment. (Laughter.)

Mr. Starr—I think the object of meter rent is not so much to get pay for the meters in actual use as to get pay for meters not in use. We have adopted the meter rent system in our town. We had quite a number of offices and some small families who would not burn in many months of the year 200 feet per month. Some consumers paid 25 cents per month the year around for 5 or 6 years, or maybe 10 years. The meter rent was charged for the purpose of preventing parties demanding meters where the consumption was so so little it would not be profitable. When you come to figure down the cost per 1,000, it runs into such infinitesimal amounts that it is hardly worth while to calculate. I see in this paper that the cost of a 3-light meter per 1,000 is $0.023; 5 light, $.018; 10-light, $.014; 20-light, $.01; 30, 60 and 90-lights only came to $.01 per month—too small an amount for a gas company to figure on; too much work in it. I would be sorry if the

time comes when our profits are so light that we would have to figure down to that small a calculation in order to live. I believe in charging pretty fair prices (laughter and applause) and then let these incidentals come in as incidentals. I don't charge a very big price for gas, I admit, but I charge enough to pay for the meters; and I don't think we want to come down to the fine calulation of figuring out every man's service charge or meter service, and apportion out the cost of every man's service pipe and meter to the amount of gas he uses every year. If you would make the calculation and submit it to him, he would wonder what it was. My idea of meter rent is just barely to shut off those who would like to have gas light for an hour or so, by making them pay the charges for it. If it don't cost them anything, they will have a meter; but if it costs them 25 cents a month, they are a little more careful of it.

Mr. Hurlburt—In regard to the rates charged for gas stoves and gas engines, we make a rate for such customers in the summer season only. We only make a rate for gas stoves during 6 months of the warm season.

Mr. Gemuender—Do you make a difference in the night rate in the summer time?

Mr. Hurlburt—Different only for gas stoves.

Mr. Faben—Mr. Gemuender makes the statement that a certain percentage of consumers use an amount less than $1, and another per cent. burn less than $1.50 on an average through the year. I would like to ask him if he inverted that calculation, and estimated what percentage of gas was used by the different sized consumers.

Mr. Gemuender—I have not made that calculation.

Mr. Faben—I do not know that I can quote it correctly, but it is somewhat like this in our case. The bills of a trifle over 10 per cent. of our total list of consumers were less than 50 cents, and averaged about 30 cents; 20 per cent. of them had bills over 50 cents and less than $1; about 33 per cent. of them had bills over $1.50 and less than $2; and the remaining 35 per cent. were divided between those who burn over $2 and less than $5, and over $5 and less than $10; and a very small fraction of 1 per cent. of the total list of consumers burned $20 worth per month. Now, inverting that proposition and seeing who took the gas, showed that only a very small percentage of the total amount was burned by the first 65 per cent. of the consumers. In making a graduated scale of rates on this basis, giving the large consumers the benefit of low prices and establishing the low rate of $1 for the consumer who burned an average of more than $20 worth, and bringing that up to $1.35 a 1,000 for those who consumed smaller amounts, the pay received for the whole amount of gas consumed, would be less than $1.07 per 1,000, notwithstanding the percentage of consumers paying the maximum price was largely in excess of those paying the minimum price; because a big percentage of the total number of consumers represented but a small per cent. of the total send-out, indicating this fact, that it is the large consumers who make it possible to give even a moderate rate to the small consumers.

Mr. Allen—For the last half dozen years since I have found out what a clever lot of men the gas people are, I have been sorry that I was not born in a gas house. I am comparatively a new man in the field, but it strikes me, with all due deference to the remarks that have been made, there is no difference between selling gas and selling any other goods. I have hammered around over this country for a good many years selling goods, and I believe any wholesale house that will adopt a one-price business will starve to death from one of two causes. Either they will have nothing but very small customers and the volume of business will be too small to pay them any profit, or else they must sell correspondingly cheaper to larger customers. No man can go into a wholesale house and sell goods at the price he expects to get and does get when he sells to small customers; selling gas is similar to selling other goods, and it is only fair to presume that just as good business ideas are used in other lines of business as in our own. Now, why is it right that a big consumer should pay the same price per 1,000 as the small consumer? Why is a man burning $1,000 worth of gas a year expected to pay the same in proportion as the man that burns $10 worth per year? The $1,000 consumer has his bill presented to him, and he writes out his check, paying for it; but away out some place in the suburbs is somebody who won't burn an average of 50 cents per month, and, perhaps, if you go to collect that amount, you have to call two or three times before you find that somebody with that 50 cents to pay the bill. Now, I would not say to one man who burns $1,000 worth of gas that he could have the gas at a given price, unless I made it a general rule that those who burn that same amount of gas could secure that price. Then, where does your little consumer get any chance to complain? There it is for him. If he wants his light at that price, let him burn that amount of gas. It strikes me that putting the price the same to everybody is not fair; it is not businesslike. It won't popularize any company, and I cannot see the point in it. Now, as to gas stoves and gas engines, I cannot see where the point is in reducing the price to them. The gas stove as at present constructed, with coal at the average price, is as cheap a thing as they can cook with anyhow. It is as cheap as coal. The gas engine is cheaper than the steam engine for the class of work where a gas engine would be used. And in addition to that, here is a family, doing their cooking with a gas stove, consuming, say, $4 a mouth, and that man's bill may be $5; while in the very next house may be a family without a gas stove that will burn $10 worth for lighting alone. Why should the man who burns the smaller amount have a lower price? It is not necessary to give a reduced price (speaking from experience) in order to sell gas stoves. A gas stove, as at present constructed and with ordinary care, is cheaper to-day than a coal stove for cooking purposes, and they will sell without any reduction in price of gas. I am in favor of selling gas just precisely as you sell any other class of goods; the larger the amount which a man uses, the less the price—and let everybody have the same chance to get it at that reduced price, provided they use the larger amount.

Mr. Gemueuder—Mr. Allen says, "Ours is like any other business." So it is, and we are governed by the same laws of supply and demand that regulate any other business; but if my promise is sound we have only one customer, and that customer is the community as an aggregate, and our dealings and contracts as to rates are with the community as a whole and not with the individual consumer. If you will bear this in mind you will more readily comprehend what I have been advising.

On motion the thanks of the Association were tendered to Mr. Gemuender for his paper.

Mr. George Osius, of Detroit, Mich., then read the following paper on

THE TESTING OF AMMONIACAL LIQUOR.

Mr. President and Gentlemen: The subject upon which your committee has requested me to prepare a paper for our meeting might have been assigned more properly to one of our members who has made the science of chemistry a subject of deeper study than the duties of my business have permitted of my doing.

I shall, therefore, confine myself, in dwelling on the above subject, solely to methods which may be applied with comparative convenience to practical use, being based upon experience directly applicable to the business of selling and buying ammoniacal liquor in its various forms. In order to arrive at correct conclusions it will be necessary (1st) to investigate the chemical composition of the ammonia salts in crude gas liquor; and (2d) to observe such changes in the same as are brought about by converting the crude product into a concentrated form.

To avoid confusion in the distinction of the liquor, I will call the ammoniacal liquor, as collected from the gas works and before it is concentrated, "crude liquor," and will refer to the finished article, after it has passed the apparatus, as "concentrated liquor."

I will also assume that one degree (1°) Twaddle equals two ounces (2 oz.) in strength, and four ounces (4 oz.) strength contain 1 per cent. of ammonia (NH_3), and on such assumption shall base my further remarks.

Various methods are being applied to estimate the amount of ammonia contained in the liquor, some of which are justly entitled to a claim for absolute correctness, while others cannot be considered chemically accurate, but yet fill the requirements for technical use very well. The steadily increasing production of ammoniacal liquor, not only as a bye-product of the manufacture of gas, but also as a result of more economic and successful operation of coke ovens, from which enormous quantities may be expected at any time, make the industry of producing, buying and selling ammoniacal liquor an important business. It is, therefore, very essential that a convenient mode of testing crude liquor should be universally adopted.

The chemical combination of ammoniacal liquor is extremely varying, and not only depends upon the kind of coal consumed in the process of carbonization, but to a very large extent on local conditions. As you are aware, varying heats in retorts, more or less combustion of air, or the changing temperature of the gas before entering the scrubber, will influence the formation of ammonia and ammonium compounds. Your coal, even if received from one mine, will vary in its qualitative properties, and may be more or less favorable to the formation of ammonium salts, and the density of the liquor is strongly influenced.

It is on this account that the custom of estimating the strength of concentrated liquor by its density as indicated by the Twaddle hydrome-

ter, is highly deceptive and not applicable in all cases, as a few practical experiments will prove, and which I shall make for a better illustration after concluding this paper.

For convenience sake, the Twaddle hydrometer may be used in establishing the approximate strength of crude liquor. Any carbonates or sulphides contained in the crude liquor are represented in a small quantity only, and in proportion to the strength of the liquor. The indicated degrees would, therefore, but slightly deviate from the correct amount of ammonia, the total amounts of ammonia and ammonium salts being small.

It is natural that a concentrated liquor should embody more ammonium compounds in a given quantity, say in one gallon, than are contained in the crude liquor, and, therefore, a Twaddle test cannot be resorted to for testing an average commercial concentrated liquor.

Another mode of testing either kind of liquor, and which is indisputably a correct system of testing, is the "distillation" or "volumetric" test, perhaps more rightly called the "laboratory" test. While this test offers the means of determining exactly all ammonia contained in either liquor, it is of more specific value if you desire to estimate all ammonium compounds contained in the crude liquor (in both the fixed and the free state). It is not a convenient test to make, nor is it often applied to concentrated liquor on account of the lengthy and complicated proceedings necessary to obtain correct results, and its application will not be generally found.

To apply this test, a known quantity, usually 10 cubic centimeters of crude liquor is placed in a flask "A," and a small amount of caustic soda added to liberate the fixed ammonium, such as sulphide, chloride, sulphite, sulphate and others. Flask "A" is connected by a glass tube to another flask "B" containing some water. Flask "A" is placed over a Bunsen burner and gradually heated to boiling temperature. All ammonia is thus liberated and passes through the tube into flask "B," being there absorbed by the water. Usually 3 or 4 hours are required to obtain a thorough distillation. After the evolution of the water in flask "B" has ceased and the application of some litmus paper has convinced you that all ammonia has been driven off from the liquor, some litmus is added and a standard solution, consisting of 28.82 grams of sulphuric acid (H_2SO_4) diluted with distilled water to 100 cubic centimeters at 60° F., is slowly run into the liquor of flask "B" until its contents change to a light red color. The number of cubic centimeters thus added to the distilled liquor, equals the quantity of ammonia in per cent. This test may be applied to either crude or concentrated liquor with equally correct results, providing extremely careful attention has been given to each detail of the operation.

Another mode of testing concentrated liquor is in vogue, usually known as the "saturation" or English test, and is largely applied in England.

Being very simple in its application, and easily conducted without specific knowledge of chemical mathematics, it may be considered as an acceptable mode of testing and could be universally adopted as a convenient means of determining the strength of a given liquor, as nearly accurate as present conditions require. The English formula is as follows:

16⅓ ozs. avoirduqois of sulphuric acid of 66° Baume at 60° F., are dilu ted with soft water to one imperial gallon. This solution is then run into 16 ozs. of ammoniacal liquor until enough has been used to color blue litmus paper into red, indicating that enough acid has been used to neutralize a gallon of liquor.

As this test is not applicable to American weights and measures, and also wastes more than necessary to give equally correct results, I have converted the same into American units, proportioned to 100, and use the following:

Eleven liquid ounces of sulpluric acid, full 66° Baume at 60° F., are diluted with soft water to 40 ounces. A graduated tube calculated on above basis is filled from this solution, and so much of it mixed with 2 liquid ounces of ammoniacal liquor as will be required to turn blue litmus paper into a bright orange-red. The number of ounces of the acid solution thus used corresponds to the number of ounces of pure sulphuric acid required to neutralize 1 gallon of ammoniacal liquor and represent 1 per cent. NH_3 for each 4 ounce graduation.

The 2 oz. of ammoniacal liquor should be diluted with about 1 pint of water before saturation, as otherwise an escape of ammonia might be caused by a sudden rise of temperature through the acid.

The acid must be of full strength, and careful attention should be given that none of it is lost after being measured. As but small proportions are applied, this is of the greatest importance, and if not exactly observed may cause a discrepancy of from 5 to 10 ounces in the ultimate results in the tests.

To avoid inaccuracy in preparing the test solution, and to simplify still more the preparation of the acid formation, I have lately adopted and strongly recommend that the solution be prepared upon a specific gravity basis.

A small portion of any sulphuric acid obtainable at any drug store is put in a strong receptacle and *soft* water slowly added to it. This solution should be thoroughly mixed until a specific gravity of 1.280° Baume, at 60° F., has been attained. A little practice will soon show the degree of the accurate specific gravity at a higher temperature, and thus save reducing the temperature to 60° F. Otherwise the test is concluded as stated above and will require but a few minutes.

As this test method does not depend upon the use of a strictly 66° Baume sulphuric acid, and as the solution may be prepared in any quantity, it is by far preferable for commercial use. It will prevent possible errors frequently made by inattention to minor details, and facilitate transactions between seller and purchaser.

Any of the solutions referred to should be kept in a closed bottle for future use, in order to prevent any changes of gravity which would vary its calculated strength and lead to errors in the test.

While adding the acid solution to the liquor, the latter should be continuously stirred to aid in completing the combinations of the liquids.

Discussion.

The Chair—In connection with this paper we have in the Question-Box, bearing upon this same subject, question No. 8—"What must be the strength of ammoniacal liquor in order that a pound of it will yield a pound of sulphate of ammonia?"—and also question No. 13—"What experience has been had in storing gas liquor above 8 ounces strong in cemented cisterns? Wouldn't the cistern leak badly in a very short time? What is the strongest liquor that can be shipped without danger of salting?"

Mr. Faben—Regarding the paper itself, I think the Association owes to Mr. Osius a very hearty vote of thanks for the full and complete manner in which he has presented it. Indeed he has covered the subject so completely that I do not see there remains much to be said. I have never had much experience with concentrated liquor. I am not at all familiar with the usual tests applied, but of all the tests set forth in this paper as applicable, the distillation test which he describes, is certainly the true test; yet for testing crude liquor I hardly see the necessity of resorting to such a test. His later test I think would apply. The reduction of the liquor by adding water to it to reduce its strength, so as to avoid all possible waste, is a good suggestion, and the reducing of the acids to specific gravity is certainly a new idea to me. What little experiments I have made in testing ammoniacal liquor, other than the Twaddle test, have been by adding 1.848, or 66° Baume, sulphuric acid to the liquor, adding it slowly until the neutral point has been reached, then, as soon as the combination of sulphuric acid with the ammonia would be in the proportion of two to one, or 25 per cent. of the weight would be ammonia, one-third of the amount of grains or ounces of said acid used would determine the strength, or would be the number of grains or ounces of ammonia; one-third of that number of grains or ounces of acid would be the number of grains or ounces of ammonia contained in a given quantity, except that portion of ammonia that was present in the liquor in the form of sulphates or chlorides, which, I believe, would be but trifling, and not likely to lead to an error of calculation. The weighing of liquor, of course, would not do, because, the gases having passed out from it, it would depend on the weighing of the amount of acids used. The paper itself answers the first question which has been raised. It is generally assumed that the eighth of a degree Twaddle hydrometer would indicate, in 16 ounces of liquor, that there was 16 ounces of sulphate contained in it. That would be 12 ounces of acid and 4 ounces of ammonia. Am I right, Mr. Osius?

Mr. Osius—Yes; I think so.

Mr. Thompson—I would like to ask Mr. Osius if on page 4 of his paper there is not a typographical error—"This solution should be thoroughly mixed until a specific gravity of 1.280° Baume, at 60° F., has been attained." Is that correct?

Mr. Osius—That is correct; yes.

Mr. Thompson—These methods of test are altogether for concentrated liquor. In the case of crude ammoniacal liquor, such as we deal with at gas works, we have to free our salts of ammonia in order to determine the quantity of ammonia present, free and in combination, by the use of sulphuric acid. Isn't there some additional manipulation of the liquor necessary which you have not touched upon? We test our ammoniacal liquor by distilling it into sulphuric acid, and in that way we ascertain the quantity of ammonia present, combined with carbonates,

chlorides, sulphides and other forms, and in that way determine the percentage of value.

Mr. Osius—The test of crude liquor, which is such liquor as is received from the scrubber, can only be done by distillation. In order to liberate all fixed ammonia, and I believe I referred to that subject in this paper, it can only be accomplished by the distillation process. In distilling amonia gas into acid, this can be done; but it would require more time which, in this case, by using water instead of acid, you would entirely save, and in leading the gas directly into the water, you could get crude aqua ammonia charged with a certain amount of caustic soda. This, of course, would refer to crude liquor.

Mr. Chollar—One of the methods of testing ammoniacal liquor here spoken of is very good for the seller, and the other is very good for the buyer. The saturation test, which is explained last, is the test that would answer for the buyer to purchase by, but it would not give an accurate determination of the liquor, although it would do for ordinary purposes. The method to be recommended is the distillation test, on page 3. Although it would be considered a little more scientific, perhaps, yet I would recommend, instead of measuring 10 c. c. of crude liquor in a flask, to take a larger quantity and then reduce, because it is a little difficult to measure 10 c. c. accurately. You can measure 50 c. c. much more accurately and then reduce the large volume and dilute it, so that you can get your measurement much more accurately. Instead of distilling into water as is recommended—perhaps it would answer very nicely but I would have some doubts about it—it would possibly be better to distil it into a known solution of sulphuric acid. It is not difficult to procure; it can be obtained from analytical chemists. The distillation of ammonia is not at all difficult, as many people imagine. It is a matter that can easily be arranged for, and any gas manager handling any considerable amount of ammonia ought to have an arrangement for it right in his works. It is a matter that would cost $4 or $5 or $6, and two or three hours study will fit a man perfectly for it, and it is a matter of a great deal of satisfaction. If any parties want to read up on the matter they can find in "Sutton's Volumetric Analysis" a detailed description of the whole process, which will answer every necessity, although in practice the process would have to be modified some. The testing of gas liquor is certainly a very interesting question, and in the larger works it involves a good deal of money.

Mr. Printz—One question—No. 13—I was interested in, as to storing liquor. I asked that question, not knowing whether I was particularly unfortunate, or whether it was the rule. During the fall we constructed at our works a brick cistern, laid up, as we thought, in good shape, with hard brick and Portland cement. We gave it ample time—a month or six weeks—for the cement to harden; then the cistern was filled with crude liquor as it ran from the hydraulic main. The cistern was perfectly tight and remained that way for quite a while. About that time Mr. Osius built a concentrator at our works, and we pumped this crude liquor through the washer until we got it up to 8 oz. strength; but as we were not quite ready to work the liquor in the concentrator, we allowed the strong liquor to remain in the cistern. In a short time I found I was losing the liquor, and inside of a week the cistern, which held 350 barrels, was dry, the liquor having all leaked out. Thinking there might be a crack in it or something of the kind we cleaned it out, and when we came to examine it we could find nothing wrong with it; the cistern and the cement appeared to be sound. On sounding it with a hammer it appeared in good shape, but by cutting into it we found it was colored clear through, showing that some part of the ammonia had destroyed the lime. I asked this question to know whether other members of the association had the same trouble, or whether it was because mine was a new cistern. It might be, if you should take an old cistern which had been used for coal tar or ammonia liquor for years and then use it for this purpose, you would not have that trouble. Several who have been interested in this matter said to me they always stored their liquor in iron tanks, and none of them had an experience similar to mine respecting a new brick and cement cistern.

Mr. Osius—I have a gas works in view where they built a new cistern covered with cement coating, and they have also stored gas liquor in that cistern for a long time, even during the summer time (the liquor was as strong as 8 oz.) but none leaked out. As far as my knowledge goes, they also used the best Portland cement. Of course, there may be something in Mr. Printz's suggestion that a cistern saturated with tar, being an old cistern, would be tighter perhaps than a new cistern; but in the particular case reported the cistern was new and it has answered the purpose very well.

Mr. Faux—I believe I can answer Question No. 13. I built a cistern somewhat after the plan followed by Mr. Printz, but I pumped mine full of tar before I put in the ammoniacal liquor, letting it remain in there three or four days before pumping it out, and I never had any trouble. The latter portion of Question 13 I would like to have Mr. Osius answer, if possible.

Mr. Osius—"What is the strongest liquor that can be shipped without danger of 'salting?'" That depends largely on the composition of the liquor. Liquor in ordinary conditions would not "salt" at about 50 or 60 ounces of strength; but it may often occur that liquor is very dense, and contains large portions of salt, a condition which is governed by the use of coal, and in that case, of course, the liquor would be apt to "salt" much quicker than in the other cases. In my experience I have known liquor of 7 or 8 ounces in strength to salt, and I have also had liquor of only about 50 ounces to form a very strong salt, so that it largely depends on the density, you may say, of the liquor.

Mr. Chollar—The term "salting" of liquor, I presume, is meant the throwing down of solid salt. The tendency of throwing down precipitates will be almost directly in proportion to the amount of carbonates found in the liquor. Take crude liquor from the hydraulic main and condenser, which contains a large amount of carbonates of ammonia, and the concentrated solution of carbonate of ammonia would be about 8 to 10 ounces; consequently, whenever the solution of ammonia is of about, or when it passes beyond that strength, it will be like salt in water—it won't hold it; it will go down. But when you pass on to the scrubbers the carbonates have nearly all been removed previously in the condensers and hydraulic main, and there you have largely the sulphides, and your liquor can be very strong indeed, without throwing down precipitates, or without "salting," as it were, and the carbonates will be largely decomposed, so that you cannot expect to get concentrated liquor very strong without its throwing down the precipitates just in proportion to the amount of carbonates and chlorides in the solution.

The President—Question 18, "Is there a market for ammoniacal liquor as found in small works, or does it have to be of a stipulated strength before it has a market value?"

Mr. Osius—So far as my knowledge extends, I believe not; if this question refers to the crude liquor after it has been delivered from the scrubber. We did, years ago, transport some crude liquor for manufacturing purposes, but the enormous freight rates prohibited that matter almost entirely. The railroad companies were not able to see the advantage in transporting it sufficiently to reduce the rates to a proper basis; and to my knowledge I think it has been abandoned altogether, unless it is a place perhaps two or three miles away from a large factory. Therefore, the liquor should be either manufactured into sulphate of ammonia or into concentrated liquor at the works. To my knowledge, they are the only two products in this market. Of course, for sulphate of ammonia and concentrated liquor there will always be a market, in this country at least.

The President then called on Mr. Osius for an answer to Question 8.

Mr. Osius—One hundred pounds of sulphate of ammonia would contain 25 parts of ammonia and 75 parts of acid, and, therefore, I would answer this question by saying a proportion of 1 to 10; in other words, 10 lbs. of 10-oz. liquor would be equal to one pound of sulphate.

Mr. Chollar—I don't think any member need trouble himself about that question at all, because he will never find any such liquor as that.

On motion, a vote of thanks was extended to Mr. Osius for his paper.

Mr. C. H. Marden of Coshocton, Ohio, then read the following paper:

HOW TO PUT A SMALL GAS WORKS ON A PAYING BASIS.

Mr. President and Fellow Members:

I have been requested by our secretary to prepare a paper upon the question, "How to Put a Small Gas Works Upon a Paying Basis;" and I shall briefly outline my experience in connection with two such plants. It is not my intention to treat the subject

in a scientific way, or to give you any estimate of the various expenditures connected with such concerns; but I wish to speak particularly of those equally important business principles which underlie the successful management of any enterprise.

It is indeed much more difficult to restore to usefulness a worn-out plant, and to retrieve the lost reputation of one which has been poorly conducted, than to build and start one anew; and whoever attempts to restore such a plant to a position commanding the respect of consumers, must be courageous and prepare himself to struggle with many and great difficulties. But, as in every other honorable occupation, industry and strict attention to business will win in the end; and though at times one will feel despondent, perseverance and honest methods will carry him through.

A new company has only to build up a reputation, but a reorganized management has to wipe away the stain of mismanagement of those who have gone before, and then patiently make its own reputation. Whenever a company allows a plant to once get out of repair, trouble comes and consumers stop. For instance, with the plant at Coshocton, everything was in bad condition. When I went to that place there were not over one dozen good meters owned by the company; the retorts were worn out; the mains leaked; the holder was almost useless both, from its condition and lack of sufficient capacity; the list of consumers was very small, and the gross earnings of the plant for the first month were only $66. After repairing the works, I made a personal canvass of all those who had ever used gas in the town and tried to get them to renew its use. The estimation of the works had fallen so low that in some places my solicitations were received with laughter and derision; in others, were taken almost as an insult. The faith of the people in the plant was entirely shaken; and though I labored hard and diligently, for three or four months there was no visible increase in the number of consumers. It seemed as though there was to be no reward for honest efforts. I felt at times discouraged, but continued on and reward at length came. In 2½ years the number of consumers increased five-fold and the quantity of gas consumed twelve-fold; and I may safely say that the present year will see this amount increased at least a third. This result can all be traced to hard and patient work.

The manager of a small plant has many more duties than the manager of a large one. He must watch carefully every detail of the work. There is no division of labor here. He must see to all things in connection with the making and consuming of the gas, the purchasing of materials and supplies, and in addition must oversee the fitting of fixtures, setting of meters, rendering of statements of gas used and the collecting of bills. In this connection he hears all the complaints of consumers, just and unjust, and must often manage carefully and ingeniously in order to continue on his list all his old patrons. One will complain of gas leaking in his house, and always wants it repaired immediately. It may be only some slight defect, as a loosened fixture key that needs tightening; or, more probably, the fixtures are worn out and comparatively worthless. Now, worn out gas fixtures are just like worn out men—they can only be given temporary relief, and the longer they go the more doctoring they require, until at last they reach that condition beyond which it is no use to labor. And the owner of worn-out gas fixtures is just as loath to acknowledge their uselessness as is the owner of the worn-out body. It is necessary in these cases to take the situation calmly, reason as best you can with the consumer, and endeavor, if possible, to induce him to allow you to replace the worn out parts with new and good ones.

One of the first requisites that naturally suggests itself is to furnish a good quality of gas. This is something which the manager can control, and which he must control; for pure gas, furnished at a moderate price, is one of the best recommendations possible for a gas works, and makes the strongest argument that you can use when trying to extend your list of patrons. In truth, you cannot succeed without this; and never was it more necessary to make a good quality of gas than at the present time; for competition in the production of artificial light is all the while growing stronger, and electric light plants, heretofore found only in cities, are pushing their way into the small towns and are striving powerfully for popular favor and support.

The regulation of the price of gas is a matter requiring study. There is no universal rule as to the amount of profit to be charged over and above the cost of production and distribution. This amount varies with attending circumstances, and I could not name an absolute figure that would apply equally to all places. Of course, the lower the rate charged, the larger will be the list of consumers. But there is a point below which, however large your list of consumers may be, you cannot maintain your plant upon a paying basis; and the rate charged should settle at the figure which will insure the greatest net profit for the labor performed about the plant and the capital invested in it.

Another observation may well come in here: Be accurate, too, in reading your meters. Many of your consumers can and do read their meters every month and will notice a mistake very quickly, especially if it be in your favor. The mistake once made, though, it is easier to correct an over-reading than an under-reading; but with due care, there is no reason for a wrong reading either way.

Another matter to be observed is, that the management of a gas works must be progressive. It is impossible to fix a boundary in any line of human work beyond which man will not devise things to satisfy existing needs. Methods of production change and vary, new machinery is invented, new fixtures are made, and it is a primal obligation on the part of the manager to be alert, to keep fully abreast of the times, and give his consumers the benefit of all the advancements made in this industry. Now, supplemented by a thorough knowledge of the manufacture of gas, these few considerations will do much to answer the question with which we started. They are of as much importance and as necessary to the successful operation of a gas undertaking as is the understanding of the process of production.

Discussion.

Mr. Clapp—I have had some of the experience recounted by Mr. Marden, in resurrecting a run-down gas works. I heartily endorse all he says. On taking charge of a little gas works that was run down, the first thing I sought to do was to make good gas, the same as we would with any other article we wanted to sell—to furnish a good quality. I sold the kind of gas the people wanted. They always wanted a good article and they bought it. The first month I run the works we sent out 175,000 feet of gas; last October, four years from the time I commenced, we sent out nearly a million. In connection with this subject, and while the paper in regard to uniform prices is still in our minds, I want to say I do not believe I could have made a success of these gas works if I had been compelled to charge a uniform price. In some cities or towns it might be possible to do that; but in a small town where there are large factories, it would be impossible to get them to use gas at a price that we could afford to sell it at to all consumers. I can hardly see, if the price of gas was so low that it could not be reduced by scaling it and making it profitable, we had better charge a uniform price. If we could afford to sell gas at $1 a 1,000 and we thought it best to put gas at $1 for heating and for gas engines, or for day consumption (and certainly no one can sell gas for less than $1)—in that case a uniform price might do; but in our case we could not do it. We could not afford to sell gas at $1 a 1,000; and we could not sell gas to many of our consumers if we put the price at our regular selling price to other consumers for lighting. So that the only way I think to make a small gas works pay is to know what you can produce gas for and sell it at a reasonable price, and scale your prices. Make a good quality and you can sell it. I went so far as to work up the business ahead of my capacity, by going out among consumers and soliciting custom personally. As Mr. Marden said in his paper, the manager of a small gas works must superintend the whole thing; not only the distribution, but the manufacturing also, and the reading of his meters, etc. It is necessary to do all that, and by getting the confidence of the people there is no question about the profitableness of any small gas works, if you distribute from it a good quality of gas.

Mr. Starr—I think Mr. Marden omitted one thing in his recommendations. He says to make money in a small gas works you should have a good quality of gas and a moderate price. That which he omitted is, he ought to put in big burners (laughter); that's the point; put on big burners (renewed laughter). I expect I have given away in our town $10,000 worth of burners—well, five, anyhow. I have been supplying them for years. But the mistaken policy I had for a number of years was to furnish a small burner and a high price. I charged $5 at first; and then we came to $4.25, $3.60, $3, $2.50, $2, $1.80, $1.60, $1.20—the last 4 or 5 reductions were made in about 8 or 9 years, and we never commenced making money hand over fists until we got way down (laughter); but when I commenced to reduce this price from $2 to

$1.80, $1.60, and so on, I commenced furnishing big burners (renewed laughter and applause). I don't know that we have furnished a burner which will burn less than 6 feet to the hour, for years; and what was the result? My customers were better satisfied, paid their bills more cheerfully than they ever had done. Why? Because they had a big light, and they saw what they got. When I furnished them small burners they had a pinched-up light, and kicked on their bills because they had to get glasses to read by lamp light; but when they had a big light and could read anywhere in the room, they were pleased and paid their bills without objection. I will guarantee there is less complaint in our office about gas bills than in any other place in the country almost; although I will admit that gas companies have a great deal of contention in their offices. My point is to furnish big burners, because while selling lots of gas you give a man a good light and he is willing to pay for a good thing. That is the true policy of a gas company, I think. (Applause.)

Mr. Cantine—I have had more or less experience with burners, and with coal gas I find the most economical burner for the consumer is the common ordinary burner which consumes about 9 feet an hour. It is the most economical and the cheapest, and will give more light for the money than any other burner, smaller or larger.

Mr. Allen—I want to corroborate the idea just expressed. I knew a gas company once that were afraid to put on big burners. They started out with small burners, beginning with a five-foot burner, then a six, and next a seven-foot burner, and now they are talking about putting on nine-foot burners. I believe a man will pay a gas bill of $5 or $6 a month without kicking if his light is good, when the same man will "kick his harness off" at a bill of $1 if he has to light a coal-oil lamp to read his newspaper by. It is not buncombe; it is a fact. What we want to do is to furnish good gas and plenty of it, and then you will get rid of the kicking; there won't be much kicking if the light is satisfactory.

Mr. Tayler—This is a subject that perhaps a majority of the members of this Association are deeply interested in, because I believe that probably a majority of them represent small gas works. I think the points made in the paper are very good. I do not think they are all the essentials, however, which go to make a gas works a success. I think they must reach out into new channels for trade, and push business as much as possible, especially day consumption, for fuel, cooking, etc. In other words, as has been said, to sell the gas. I agree very heartily with Mr. Starr in his statement as to large burners. Our custom has been to use large burners always, and while we have been accused of about everything that any other gas works has been accused of doing, there is one notable exception—we have never been accused of furnishing poor gas; and I have no doubt that we get the full benefit which we ought to receive by reason of that fact. I would not wonder if it is not attributable in some measure to the fact that we always furnish larg burners on our street lamps, and we furnish the city twice as muc gas as they pay us for The result has been that strangers coming to our town notice and remark upon our good gas, as they supposed. It was both, probably, the large burner and the good gas; but the large burner is what they notice more than the good gas. They notice, at any rate, that we are furnishing good light. They could not tell good gas from poor gas as readily as a gas man could, but they will invariably compliment us on our good gas; and I have no doubt that that fact has kept us from having trouble with our "City Fathers" for some considerable time.

Mr. Starr—With reference to giving the city more gas than they pay for, Gen. Hickenlooper, when at our place some time ago, made the remark: "Starr, you are furnishing big burners." "Yes," I said, "it pays to be liberal with the city;" and the result is that for the last five times I have asked the city for charter privileges, I believe every member of the Council voted for it and gave me just what I have asked. I suspect that it is a pretty good record. Now, then, I light my own town well with gas, and when they come to contract for electric lighting, I furnish them with a specified electric light for a specified price—it is pretty low; I only get $4 a month, but I only light certain places. They say they would rather have gas on the street than electric light, because it lights up the alleys and places away from the corner better than electric light; and good gas is as good as electric light, anyhow. For that reason we have no trouble with the electric light part of it. We have both of them. I am running an arc and an incandescent electric light plant, and they often tell me they would just as soon have a good gas light as an electric light. I have a customer in mind who ordered his electric light taken out, and said he would rather have gas. That is the way to make a gas works pay. When I commenced, I think at $4.20 a thousand, my sales were eleven millions. In the course of about two years I reduced the price to $1.80 and my sales were 30 millions. That is just the difference. Our town didn't increase to make up the difference at all; it has had only the natural growth. The increase was due to the fact that the people knew we were furnishing a good quality at a reasonable rate.

Mr. Nash—Speaking about how to put a small gas plant on a paying basis, I don't believe you could do it and use old apparatus. I think one of the essentials is to have your apparatus in good shape, before the works can be put on a paying basis.

On motion a vote of thanks was extended to Mr. Marden for the paper read.

The meeting then adjourned, until March 17th, 1892, at 9 A. M.

SECOND DAY—MORNING SESSION.

The President announced the following

COMMITTEE ON NOMINATIONS.

Eugene Printz, Zanesville; George Matt, Lancaster; Jerome Penn, Washington C. H.

Also, the following

COMMITTEE ON NEXT PLACE OF MEETING.

Charles H. Welch, Athens; Joseph Gwyn, Steubenville; Thomas A. Bates, Portsmouth. It was also announced that the Columbus Gas Light and Coke Company had formally invited the Association to meet in Columbus, Ohio, each and every year.

Mr. Graeff, of Committee on President's Address, submitted the following report:

REPORT OF COMMITTEE ON PRESIDENT'S ADDRESS.

"The Committee on President's Address commends the address to the careful after-reading and consideration of the members of the Association, as a well-prepared and thoughtful paper.

"The Committee recommends the reference of the suggestion as to preparation of papers and debate to the Executive Committee, under the provisions of the new Constitution.

"It further recommends the adoption of the action proposed by the President with reference to the death of our esteemed fellow member, E. M. Russell, and the recent affliction of Mr. Wm. McDonald."

IN MEMORIAM.

The report of committee on President's address was adopted, and the Secretary instructed to make an appropriate minute as to the death of E. M. Russell.

Dr. McFadden then offered the following resolution:

"*Whereas*, We have learned with profound sorrow of the sad bereavement that has befallen our esteemed and much loved member, William McDonald, through the loss of his wife by death; therefore,

Resolved, That this Association do hereby express its heartfelt and deepest sympathy for Mr. McDonald and his family in this their great affliction; and,

Resolved, That a telegram expressing the sympathy of the Association be sent to Mr. McDonald by the Secretary."

Dr. McFadden—Mr. President and members of the Ohio Gas Light Association: I came here as a visitor to seek pleasure and enjoyment as a listener, and little did I dream that circumstances would call me to the performance of so sad and so mournful and so solemn a duty. Thus, however, is illustrated the vicissitudes of life. It is but a single step from joy to sorrow; in the midst of life we are in death. Life has its lights and its shades, its sunshine and its gloom. Each of these phases has its lesson to teach, and let each one of us learn from it what all must sooner or later experience; let each of us fit ourselves for the transition. Knowledge obtained by actual experience is valuable and enduring and a "fellow feeling makes us wondrous kind." Such a feeling I have, and such a knowledge my own late and similar affliction has rendered lasting. As burdens divided become lighter, so sympathy extended relieves; but time alone can sooth the wounds of sorrow. Arteries severed may be ligatured by surgeons, but who can bind up and sooth our lacerated nerves? One alone can renew

the ties of sympathy that bind two loving hearts in one. I had not the pleasant privilege of a personal acquaintance with the deceased wife of my esteemed friend and fellow-member, William McDonald, but I have the assurance that she was a Christian woman, a loving and a beloved wife, and a devoted mother, whose highest, noblest and truest traits of character were manifested in her church and in her home, around the fireside where gathered oft their six children and their father, the offspring and companion of her life and love, and where her love ruled as queen of the home and as the angel of the household. How wise the Master! Hence his provision of a helpmate in the tenderest, sweetest and truest relations of life, as wife and mother. She has passed through that change that has enabled her to enter into her rest, but her works do follow her in the training of her children and the impress she has left on the partner of her love. In his loneliness and bereavement he has the sympathy of us all. It is only such as my friend McDonald and myself have experienced in the severance of those tender ties, who can fully appreciate the words of Bonar, in his "Master's Touch":

"In the still air the music lies unheard;
In the rough marble beauty hides unseen;
To make the music and the beauty needs
The Master's touch, the sculptor's chisel keen.

Great Master, touch us with thy skillful hand;
Let not the music that is in us die!
Great Sculptor, hew and polish us; nor let,
Hidden and lost, thy form within us lie!

Spare not the stroke! do with us as thou wilt!
Let there be naught unfinished, broken, marred!
Complete thy purpose, that we may become
Thy perfect image; thou, our God and Lord."

The resolution offered by Dr. McFadden was adopted.

Mr. Henry Padan, of Portsmouth, Ohio, then read the following paper on

THE RELATION BETWEEN INCREASE OF OUTPUT AND DECREASE IN COST OF MANUFACTURE AND DISTRIBUTION.

The question before us is one which is necessarily as old as organized industry. Even if it was not the chief consideration (or did not enter into the consideration at all) to induce men to take the initial steps toward systematic production, the fact is that increase of output does actually subserve the interests of economy in manufacture in nearly every industry. This relation must necessarily have forced itself upon the attention of progressive men who entered the arena of commercial strife.

No doubt the primary inducement to increase the output was the increased profit in view, which may have been computed to keep pace with the increased product. These two factors, product and profit, may have been regarded as bearing a constant ratio, swelling and shrinking together, just as the ocean tide swells and recedes with the coming and vanishing moon. But that this ratio is not constant must soon have been detected by the alert observer. It may not have been taken into account in the days of pioneer commerce, when profits were large in comparison with the magnitude of transactions. But the growth of population and the strife of competition have gradually narrowed the margin of profits to that extent that the only escape from extinction lies in the saving of cost attending the systematizing of labor and the increase of production.

The principle has been carried so far in our day as to attract the attention of legislators, who see in the formation of gigantic monopolies and trusts a menace to the peace and prosperity of the general public. These so-called octopus corporations have only yielded to, or perhaps rather availed themselves of, the logic of the situation.

By concentration of capital and labor, they have reduced the expense of business sufficiently to rescue the margin of profits from oblivion. Incidentally this concentration has extinguished competition largely, and thereby further extended the margin of profits. While this, as every other industrial problem, is a proper subject for legislation, it must be remembered that self-preservation is the first law of nature, and corporate monopoly seems to be in harmony with the genius of American legislation, which affords protection to home industry, and which means, when analyzed further, protection to the margin of profits as well as to labor.

The relation of increase of output to expense and profits is thus seen to impress itself very conspicuously upon the methods of conducting enterprises in these days. In those cases in which the field of operation is circumscribed mainly by the amount of capital, the tendency to combination and concentration is most apparent. In our business, the question of capital is overshadowed, if not entirely eliminated, by the prominence that belongs to its localization, as affecting the volume of business. What object is there in increasing the production beyond the local power of consumption? In other lines of business, patronage is drawn from the length and breadth of the land, giving capital a prominence and omnipotence in the manipulation of sales and profits. In the gas business, the exigencies of a local population at once throw around this industry an insurmountable barrier to increased production. And yet the same principle obtains, although it cannot be as profitably utilized toward the accumulation of profits and wealth.

Indeed, the effect of increased production and cost is especially marked in this business. This is due to the fact that a plant being established for the production of a small amount, an increased production entails very little extra expense. This means that the capital required for a small plant bears a much larger ratio to the volume of business than it does for a large plant. This ratio of capital to volume of business is the gist of this question. We have noticed that in miscellaneous lines of business the increase in volume affects advantageously the diminution of expense and the increase of profits. In many of these the volume of business yearly is as high as six times the capital, and the product costs within ten per cent. of the market price. If this be the case, how much more will this effect be noticed in a business such as ours, "whose yearly output," as has been said, "rarely equals one-third of the capital invested, and whose items of cost to manufacture and distribute are chiefly labor"? The increase in the output at once diminishes the relative expense of manufacturing, and the cost of distribution is especially reduced.

As the question of capital required materially affects the solution of our problem, it will be well to make a general estimate of this factor for the various sizes of towns and cities. It has been thought that the capital of a plant should be about $7,000 for every thousand people. This can be true, even remotely, only within a narrow range of diversity in population. And large cities obviously reap the highest advantage from the very large relative diminution of capital.

What has caused the marked reduction in the price of gas during the past 20 years in the localities we represent? Certainly it is not due to cheaper coal and water. These two items cost about the same as they did 20 years ago. Nor is it materially due to improvement in machinery, although the latter has rendered valuable service toward increasing the capacity of our plants. It cannot be said to be due to lower wages, which remain about the same, nor to the competition of incandescent lights. Some few items of cost have shown a slight decrease; but in the general schedule, there has been no material reduction of cost. Yet the average selling price of the leading companies of this locality is only about half the price realized 20 years ago.

What is the solution of this enigma? Perhaps some one will suggest that capital is satisfied with more moderate returns to-day. This may account for a small portion of that reduction, but the great body of it is due to the large increase in consumption. The growth in population of the cities of Ohio has been such as to more than double the demand. In addition to this increase of population, the utilization of gas for divers purposes unknown formerly, such as for cooking, heating, for elevators and engines, has stimulated production very appreciably and remuneratively.

When it is taken into consideration that a declining price will naturally induce a larger consumption among old patrons, and will attract new patronage, it will not seem strange that the volume of business will increase more rapidly than the population, nor is it surprising that dividends can be declared, with the price of 2,000 feet of gas at about the same figure as that of 1,000 twenty years ago.

Perhaps it can be justly said that gas men have been slow to recognize the peculiar advantage accruing to a large increase of business while the capital remains stationary. If it is found profitable to concentrate, and largely increase in other lines of manufacturing, in which the capital required and the cost of production sustain a much less varying ratio to the volume of business, and yet in which an appreciable advantage is realized from the relatively reduced cost of manufacturing and distribution, how readily

can be seen the advantage to a gas plant, which though running slow is running in full blast, and subject to a constant wear within and the ravages of time and the elements without, of increasing its volume of business without an accompanying addition of capital? Or, as the street car manager would say, run a little faster, and don't stop between crossings, and you can make two trips in the time usually required for one.

It will be well to impress the fact that each part of the manufacturing and distribution can be accomplished at a much less cost per 1,000 feet, when a plant increases its output. Take the case of a plant producing 100,000 feet per day in June and 200,000 in December. The cost of coal required for the additional 100,000, minus the residuals, and the wages of the extra stokers, represent the total cost of the second 100,000 feet of gas in the holder. In the cost of distribution a still greater advantage is gained. One or two extra street men, to look after complaints occasioned by the work of frost and condensation, will represent the sum-total of the extra cost of distributing the second 100,000; as the taking of meters and the collecting need entail no extra expense.

From replies made to inquiries sent to a number of gas plants through Ohio, the average maximum month shows an output considerably more than double that of the minimum month. The replies to the inquiry as to the relative cost of gas in the two months naturally show considerable diversity, although all indicate a large difference—the minimum month showing an excess of cost of 25 to 50 per cent.

It will be instructive to contrast the large plants of the state with smaller ones, in the matter of relative cost of production and output. The large plants show a volume of business of from one million to five million feet daily. As most of us know who are connected with small gas works, the public cannot see why gas cannot be sold for the same price in small towns as in large cities; and the manufacturer of gas in a large city does not seem able or willing to sell his commodity any cheaper than a plant producing, perhaps, but half the amount.

It will thus be seen that the public and the large manufacturer of gas agree that there is a fallacy in the view generally entertained by large manufacturers, namely, that the cost of the manufacture and distribution of gas varies inversely as the increase in consumption. I wish to disclaim at the outset that this variation presents anything like unbroken regularity, or that the ratio of variation can be quantitatively computed as between any two plants; but I do claim that there is an inverse variation, and will adduce the following consideration in addition to what has been already said, in substantiation of this position.

The large manufacturer is able to apply profitably the principles of division of labor. No one will deny that to secure the best results from every laborer, it is important to reduce the variety of his work to a minimum. This saves the time required for changing from one species of work to another, and secures the highest skill and speed within the capacity of the individual. To realize the utmost advantage from the adoption of this principle, the daily production must be sufficient to warrant a complete classification of the work, and the assignment of each workman to that class of work wherein he manifests the proper speed and skill. It has been demonstrated that the highest standard of speed in labor has been attained where large numbers are engaged at the same work: so that by emulation each strives to reach the standard. By division of labor we gain the time lost in changing from one kind of labor to another by increasing the output, we gain in each division by having the standard of speed advanced through rivalry. From this it would appear that, to secure the best possible results, the production should be great enough to offer this incentive to speed in each department of the work. It follows then that the ability to carry out this principle to any extent in the manufacture of gas is limited only by the restraints placed upon the volume of business.

The chief restraint, as has been noted above, is the local character of the patronage, the amount of which is dependent upon the population within a circumscribed section.

From the resources at my command, I should say that, taking a one million feet daily plant as the standard, a 500,000 feet plant would be warranted in adding ten per cent. to the selling price of the former. A 100,000, 25 per cent.; a 50,000, 50 per cent.; and a 25,000 or less, 100 per cent.

In this cursory sketch I have confined myself to approximate and general estimates, and the statement and review of general principles. It would be impossible to particularize, as there are sundry items peculiar to individual plants that would affect the computation and would play havoc with mathematical exactness. There are certain general principles which, if they cannot be applied as a whole in each instance, present certain features applicable to any individual case.

If I have succeeded in making a clear and succinct statement of some of these, I have accomplished the object that I have set before me.

I need only say further that we represent a business, which, if it fail to evolve sufficient reflex activity to elucidate the intricacies of its own practical operation, is able to throw light on any other subject. Let us trust that in the future, as in the past, it will be vouchsafed to us to illuminate the pathway of humanity.

Discussion.

Mr. Gemuender—Mr. Padan starts out by saying in the first clause, "Increase of output does actually subserve the interest of economy in manufacture in nearly every industry;" and later he says, "But the growth of population and the strife of competition very greatly narrow the margin of profits, to that extent that the only escape from extinction lies in the saving of cost attending the systematizing of labor and the increase of production." Then, again, he says, "The principle has been carried so far in our day as to attract the attention of legislators, who see in the formation of gigantic monopolies and trusts a menace to the peace and prosperity of the general public. The so-called octopus corporations have only yielded to, or rather perhaps availed themselves of, the logic of the situation." With this probably we can all pretty well agree. As to paragraph 4, I cannot say the same. He says, on page 2, "While this, as every other industrial problem, is a proper subject for legislation, it must be remembered that self-preservation is the first law of nature, and corporate monopoly seems to be in harmony with the genius of American legislation, which affords protection to home industry, and which means, when analyzed further, protection to the marginal profits, as well as to labor." Of course, to discuss this question would probably lead to a political discussion, so I will do nothing more than simply express my own earnest personal dissent from the sentiments and conclusions here expressed, and let that go for what it is worth. On page 5, however, there is something important. In the third paragraph on that page Mr. Padan says, "From the resources at my command I should say that, taking a million feet daily plant as the standard, a 500,000 feet plant would be warranted in adding 10 per cent. to the selling price of the former; a 100,000, 25 per cent.; 50,000. 50 per cent.; and 25,000, or less, 100 per cent. That, in my opinion, is the gist of the whole paper. The figures are important, and I would like to ask Mr. Padan exactly how he got those figures; that is, what method he employed in arriving at that result?

Mr. Padan—Those figures, as intimated below, are not exact, neither were the replies to my letter that I sent all over the State, asking for information regarding the cost as near as it could be figured, when the output was very large and when it was very small. One man said, and he is present, although I will not mention his name, that their output is more than double in December, and their extra expense for distribution almost nothing. These views are expressed, I will admit, from the standpoint of the small manufacturer. I do not expect them to accord with the ideas of the larger manufacturers, as intimated in the paper. But that is the way they seemed to be, from our standpoint, and these figures that I have given have been received by me largely in corresponding with other gas men.

Mr. Printz—Some statements made by Mr. Padan I think I can readily support, and the part that I especially refer to is that the increase of output does not increase the expense in proportion to the collection of bills, reading of meters, and so on; and for these reasons. Eight years ago we were sending out a certain amount of gas—there were about the same number of men employed to manufacture that gas, and the same clerical force in the office that we have at present; and now we are sending out fully 50 per cent. more gas, without, of course, any more help either in the office or at the works. You are all aware that any gas works requires a certain number of men to do so much work, and a certain percentage of work can be placed on the men without any additional expense. A certain number of men must be about the works, and a part of the time they are necessarily idle, when they might just as well be employed. By that means we have an increase of output without any additional expense.

A Member—I would like to ask Mr. Printz, if he was making water gas at that time, eight years ago?

Mr. Printz—We were not; nor are we at present.

Mr. Thompson—Was Mr. Printz getting full capacity out of his men eight years ago?

Mr. Printz—We cannot, in a small works, do that.

Mr. Thompson—In eight years has not the increase of manufacture necessitated the employment of some additional labor in the manufacturing department?

Mr. Printz—No, it has not; for the reason that the same number of men turn out now that much more work.

Mr. Thompson—That is the point. Mr. Padan asks "What has caused the marked reduction in the price of gas in the past 20 years in the localities we represent? Certainly, it is not due to cheaper coal and water. These two items cost about the same as they did 20 years ago, nor is it materially due to improvements in machinery, although the latter would render valuable service toward increasing the capacity of our plants. It cannot be said to be due to the lower wages, which remain about the same, nor to the competition of incandescent light. Some few items of cost have shown a slight decrease; but in the general schedule there has been no material reduction of cost, yet the average price of the leading companies of this locality, is only about half the price realized 20 years ago." In following out the arguments of this paper, he undertakes to show that the result has been obtained by the fact that the decrease in cost has been charged to the increase of output; but I think we can scarcely disregard the improvement which in 20 years has taken place in the manufacture of either coal gas or water gas. Twenty years ago coal gas men were getting little or nothing for their tar, and many were not saving their ammonia at all. The price of coke, I think, was much less then than it is at present. Probably one thing that has accomplished this result has been the increase in the manufacture of water gas, which has provided an additional market for coke; and also, to some extent, the increased production. In the manufacture of water gas we certainly cannot disregard the improvements which have taken place in the last few years, and which have resulted in our getting a greater quantity of gas from a given quantity of coal or oil, and which have enabled a certain number of workmen to very greatly increase their efficiency in the production of a certain quantity of gas. I do not think we can afford to disregard, but I think we must all appreciate the fact that increase of output very materially decreases the cost of manufacture, but I do not think that is the greatest factor entering into it. He says, "It has has been demonstrated that the highest standard of speed in labor has been attained, where large numbers are engaged at the same work, so that by emulation each tries to reach the "standard." Economy in labor may also be a very material item; for instance, in the retort house, having several gangs drawing at the same time—let them all be drawing in sight of one another, so that their work, in closing the retorts up quickly, may result in a slight increase in the quantity of gas to be received from a pound of coal. That may possibly be considered a very small item, but I assure you it does countin a large works.

A vote of thanks was extended to Mr. Padan for his paper.

Mr. J. A. Faux, of Pittsburgh, Pa., then read the following paper on

GAS BURNERS AND THE GAS COMPANY'S INTEREST IN THEM.

The attention of scientific men was directed to the construction of burners a very short time after the establishment of gas. They gave some very valuable theories in regard to combustion, constructing some of the best forms of burners, and laid down valuable information regulating the use of the same. This information, strange to say, has been forgotten or disregarded. It seems to be that the opinion existed at one time and apparently, in some cases, exists at this time, that no matter how the gas was burned, or what the size and number of orifices in the burner, from a certain quantity of gas a certain quantity of light is evolved. This idea has proved to be entirely erroneous.

When gas is ignited as it issues from the burner, its hydrogen is consumed at the lower part of the flame, and the carbon being sufficiently heated, if properly consumed, is liberated in a solid state at the upper part of the flame, where it combines with the oxygen of the atmosphere; and according to the degree of heat attained by the innumerable particles of carbon, so will be the amount of light emitted by the gas.

The matter of the construction of gas burners by which the maximum illuminating power of the gas may be developed in its combustion, being one which principally affects individual consumers, has not received the attention which its utmost importance merits. Most of the various kinds of burners in common use are extremely defective, thereby entailing upon the public a heavy pecuniary loss as well as many other disadvantages.

The universal and wasteful misuse of gas is not merely a question of economy, although the aggregate pecuniary loss must be very great. It affects in no small degree the health and comfort of the consumers. The products of combustion of a pure gas, improperly consumed, vitiate the air and overheat the apartments in which it is burned. The light from gas properly burned is much steadier, clearer and less trying to the eyesight than that wastefully and improperly burned.

The principal circumstances that demand our strictest attention in the fitting and adoption of any particular kind of burner, are the average pressure of the gas and the illuminating power of the same.

As a rule gas fitters and persons selling various kinds of gas burners are ignorant of the most important principles involved in their economical use, as well as in their highest attainment of light from the gas they consume. In connection with these disadvantages, we frequently find defective gas fitting, such as too small piping fitted with too many burners, unregulated pressure, causing imperfect combustion and an enormous loss of illuminating power of the gas, bringing the gas company furnishing the same into very bad repute as to the quality of the gas they are asking their consumers to pay for.

Flat flame burners, the one in general use, are burners which spread their flames in a broad, thin sheet. They are known as the fishtail and batswing burners. The fishtail or union jet has two orifices drilled through its tip, which are inclined toward each other at an angle of about 45 degrees, so that the issuing currents of gas impinge and spread in a broad flame. The gas in a batswing issues in a thin sheet from a slit sawed across its tip.

The Argand burner in its usual form is very useful for gas of low illuminating power. It has been improved, so that in respect to the amount of gas used, steadiness of flame, and amount of light, little further improvement is hoped for.

The common Argand burner consists of an annular ring, the upper and closed end of which is pierced with small holes. It thus produces a tubular flame, and must be protected by a glass chimney by which the admission of air to the flame is regulated.

A regular pressure is essential for the use of these burners. The flame should be of uniform height throughout, without any marked trace of the numerous jets that compose it. It should be one bright mass, except at the bottom where there will always be a blue ring. No matter what the quality of the gas may be, these are the requirements. The higher the candle power the smaller the holes in the ring and the fewer of them. In order to obtain the maximum amount of light from Argand burners the full quantity for which they are made should be consumed. To preserve strict economy in the exclusive use of Argand burners it is better to have a limited number of them with burners of both large and small dimensions, so that a number may be extinguished, rather than have some checked to only a portion of their consumption.

Of all the burners I think the ordinary fishtail (and they are frequently used) give the most inferior results when used with common coal gas.

The common fishtail burners with clay or metal tops permit the current of gas to strike against their orifices without any control or regulation of the pressure. In many patented forms of the fishtail and batswing burners, some mechanical obstructions are placed to obstruct, govern, or break the pressure, to insure more complete combustion. Screws, wire gauze, cotton and a constriction of the lower part of the burner are all in every day use. Of all the above, one of the simplest and most effective for all purposes is the one so constructed that the opening at the lower part of the burner is smaller than at the upper.

To obtain the highest illuminating power from a burner having a small opening, a low pressure of gas must be maintained, and as the size of the burner increases, within certain limits, the pressure may be increased with very favorable results. I would not recommend small sized burners as a matter of economy. A burner con-

suming as much gas as two small ones has been practically demonstrated to produce light in a very much greater proportion than the consumption of gas has been increased. The low production of light from gas is often laid to its inferior quality when the fault really lies in the manner in which it is consumed. The quality or illuminating power of the gas also has a very important bearing on the question of the kind of burners to be used. There are burners adapted to the exclusive use of coal gas, and burners for gas of higher candle power; the burners for one being quite unsuited for the other, provided the richer gas has been enriched, or its candle power raised above that of coal gas, by the use of crude oil, naphtha, or any other enriching material used in ordinary retorts. The conditions under which a 16 candle gas would be perfectly consumed, would cause a gas of higher candle power to smoke. The richer the gas the greater the difficulty in developing its full illuminating power with its complete combustion.

The richer gas must at all times be burned in a much thinner flame, or sheet, than is proper in the case of a poorer gas. The opening in a burner for the consumption of a gas of low candle power must be much larger than for a gas of high candle power.

There are at present coming into use many high candle power burners that will in the near future demand considerable attention. These are so constructed that a very much higher efficiency is obtained for the amount of gas consumed than with the present common burners.

The pressure of the gas has a very important office to fill in the matter of perfect combustion. It must be neither too high nor too low. If too low, the gas will have a dull, red and smoky appearance, and throw off considerable smoke, which, although invisible, will deposit in the room, and vitiate the air to the degree of unwholesomeness, besides causing considerable damage to the surroundings. The maximum amount of light from any gas is obtained when it is burned with such pressure as to secure perfect combustion, and is just at that point when the flame is on the verge of smoking. A gas of a high candle power can be burned with a certain amount of increased pressure. A poorer gas requires less excess of air for its complete luminous combustion. The greater the illuminating power of the gas the greater the pressure necessary to obtain complete combustion.

If the pressure of the gas at the point of emission is increased beyond a certain degree, the amount of light evolved from a given amount of gas decreases. Excessive pressure will give a roaring flame devoid of light. It is generally believed that the surrounding air cools the flame and prevents it from attaining the high degree of heat essential to produce the full amount of light from the gas that is consumed. If the pressure be excessive the gas issues from the burner with considerable force in the open air, a greater amount of oxygen is drawn in from the surrounding air, and instead of the carbon being heated to incandescence before being consumed, the heat is so intense that the carbon is immediately consumed, and little light is yielded from the gas.

The greatest illuminating power, and the complete combustion of the gas, are the two most important points to which the gas company must strive to attain for the benefit of its customers.

The gas company determines entirely the quality of the gas which it desires to sell to its customers. It should then determine to deliver it at the point of combustion in the very best practicable manner.

We will suppose the gas company has provided ample main capacity, sufficiently large service pipe, all well and properly laid, and meter and meter connections of proper capacity, then the next step in the right direction is to have the gas fitting in the buildings properly done. Rules for same should be adopted by the gas company, and all gas fitting done strictly in accordance with the same.

It frequently happens that the gas company gets the credit of furnishing a very poor quality of gas, when we can easily locate the trouble in the gas fitting in the building, assisted by bad burners.

The pressure having been so adjusted as to be, as nearly as practicable, the same throughout the entire territory supplied with gas, the gas company should now determine for the consumer the kind of burner best suited for the gas, and should at all times be provided with a large stock of these burners, and furnish them to their customers at cost.

Burners are generally sold to customers by agents and gas fitters. Consumers are frequently led to believe that by investing in their improved burner the saving of gas in their next quarter's bill will more than pay for the burner. These burners are sold without knowledge of the quality or pressure of the gas. What is sure to follow? The evils could be enlarged upon, but suffice it to say, the gas bill is greatly increased, consumer is out of humor, gas company is a fraud, etc. This can all be avoided by the gas company having it thoroughly known that it is furnishing the only burners that are adapted to the use of its gas.

A matter of great importance also is to have the consumer know hat he must at all times keep his burners clean. The gas company should furnish appliances for doing this. It should not be considered out of place to call the attention of a consumer to his dirty burners, and have him know that by his neglect he is losing considerable money, for the burners are consuming their regular amount of gas, but yielding much less light.

In treating of high candle power lamps, I will mention only two kinds, viz., the regenerative and the Welsbach. Of the former, the Siemens-Lungren is the one most used, and is made for both indoor and outdoor lighting. One difference between the lamps for these two uses is the casing which encloses the outdoor lamp. There is also an internal difference between the two classes. For indoor lighting the lamps are made to burn from the edge of the circular burner with the flame extending outwardly, while those for outdoor use for the most part burn toward the center, and the products of combustion pass up the center of the flue. In most of the lamps the gas passes from above the lamp down through a pipe in the center of the flue; in some it passes down the outside of the lamp through the arms of the harp. The gas is heated to a high degree before it reaches the tip of the burner, and so is preheated or regenerated, as is also the air for combustion. The gas consumption in any sized lamp will vary with the candle power of the gas. These lamps work equally well with 12 to 14 c. p. gas as with the 50 c. p. gas. The efficiency of the lamp per foot of consumption varies with the quality of the gas. The lamps are adapted to all illuminating gases, as coal gas, water gas, oil gas, etc. The lamps are all used with the volumetric regulators, so that the pressure under which the gas is supplied to the lamps is of very little importance, provided the gas is thoroughly fixed and clean, so the efficiency of the governor be not impaired by deposit or corrosion from the gas. Sufficient pressure should at all times be supplied to make the governor act, which should not be less than eight-tenths of an inch.

The pressure should not exceed 16 ounces, although it may go higher with no injury.

The pressure of the gas after it leaves the governor is about two-tenths of an inch, sufficient velocity only being desired to give it a very slight jet flow to the flame, allowing it to be drawn into position by the heated currents of air in the lamp.

Sometimes from deposits from the gas the tubes of the burner become clogged. A small wire will easily remove such deposits. This clogging often causes irregularity of the flame. The adjustment is very simple. After being put in position and the joints all made tight, turn the cock on full, adjust the length of flame by regulating with the adjusting screw of governor until the flame comes around the edge of the flame plate in one case or to the center flue in the other. This adjustment properly made, the lamp will work satisfactorily under varying pressure. The governor will need resetting only when the quality of the gas is changed. If the gas is not properly purified or fixed the governor may need to be cleaned in certain parts where there is any bearing. This is done with a soft stick and rag, with a little benzine. If the above conditions are closely followed the lamp will give the most satisfactory results as to economy and illuminating power.

The Welsbach incandescent burner for use with artificial gas contains a mantle, the character of which most essential part of the lamp varies with its different uses. In all the lamps, with the exception of the one for non-luminous fuel gas, the principle of the Bunsen burner tube is embodied, and in this the Argand is used. For luminous gas generally two sizes are used, viz.: 2.8 and 5 cubic feet per hour. The consumption varies somewhat in the varying richness of the gas. The candle power varies with the heat units of the gas, being generally from 9 to 11 candle power per cu. ft. The life of the mantle may easily be set at 1,000 hours, and the mantles have been tested by 2,000, 2,500, and even 3,500 hours continuous burning. However, it is not practical to claim any

such figures in the actual life of the mantle under the conditions to which the customer may subject it. The mantle ought not to be renewed under 800 hours, and at the end of that time ought to be giving a higher candle power per foot of gas than the gas could yield without its assistance. The lamps are adjusted for the different conditions and pressures and density of the gas which they are to meet. The means of this adjustment is simply a check, and is absolute for fixed or slightly varying conditions. This is found to be a much more practical method of adjustment than the use of a governor for each lamp. This lamp will work on a pressure as low as .8 of an inch, but a pressure of 1.5 or 3 inches is much more satisfactory.

If all lamps and burners are to work in a satisfactory manner and produce the most favorable results, the quality and pressure of the gas should be uniform. I have endeavored to make plain the theoretical end toward which we are all striving. A true theory once established, the determined application of same must follow as a matter of course.

Discussion.

The President—This most interesting and instructive paper is now before you for discussion.

Mr. Printz—Mr. President, I agree with you that Mr. Faux has presented a very able and interesting paper, and upon a subject to which we all ought to pay a great deal of attention. As a rule, gas companies take very little interest in their gas after it leaves the meter. I think they make a mistake, and it is the duty, as Mr. Faux states, of the gas company to determine as near as possible, the kind of burner best adapted to their gas, because it should be the desire of every gas company to furnish a clean gas with a good illuminating power. You have all noticed that our customers will take up with any burner that comes along, if somebody that has it for sale says it is patented, and they will pay quite a sum for it. The burner may or may not be adapted for gas. In our place they have a great deal of trouble with burners, the burner tips particularly choking up, and I see on reading the proceedings of the New England Association, from some of the papers and discussions therein contained, that some of the folks East have about the same trouble. We found one particular burner would relieve us of the choking trouble, and have endeavored as nearly as possible to supply our customers with that burner.

A Member—What burner is that?

Mr. Printz—It is the Bray "Special," Union Jet Burner.

The Secretary—I believe the middle one of that row of burners on the south side of the room is that kind of a burner.

A Member—It don't burn enough gas to suit Mr. Starr (laughter).

Mr. Printz—They run in numbers, 5 feet, 6 feet and 7 feet. While speaking of burners, I had the matter called to my attention, January a year ago. Our Secretary, Mr. Butterworth, was down at Zanesville, and, passing up the street with me in the evening, happening to notice a few burners that were a little dirty, he said, "Printz, we would not tolerate a burner like that in our town. We keep a man whose duty it is to go around over the city, and if there is a dirty burner he must look after it and have it cleaned or replaced."

The Secretary—I know just what Mr. Printz is going to say—that he saw half a dozen dirty burners on our streets last night.

Mr. Printz—Every time I have been in Columbus since, I have looked to see whether he has been doing as he claimed he did, and I find just as many tips in bad condition in Columbus as in Zanesville.

The Secretary—I anticipated him.

Mr. Printz—But Mr. Faux has brought out a great many good points in his paper that I think it will do well for us to consider.

Mr. Cantine—I would like to ask what the third burner on that lower row is: the one next to the Welsbach incandescent?

The Secretary—An ordinary lava tip burner.

Mr. Cantine—Would you be kind enough to turn down all the burners except those two Bray Unions, and let us see what size the flame would be under proper pressure.

(The request being complied with, Mr. Cantine continued):

Now, turn up the next one to the Bray Union; my eyesight is a little defective, but I think that first burner furnishes a better light than any of the others.

The Secretary—I find this burner is a general favorite, on account of the symmetrical flame which it furnishes.

Mr. Cantine—You must have symmetry in light also; you can get symmetry of light by getting large burners.

The Secretary—You can get these in larger sizes.

Mr. Cantine—What we want in burners is something that will eclipse the ordinary 16-candle power incandescent. Mr. Faux has evidently given this subject much study, and is very familiar with it. One objection frequently urged against gas as an illuminator is that it smokes up fine wall paper and ceiling papers of the consumers. Some think we make our gas of too high candle power. I have given it some attention, and I find, in one or two cases where some of our gas consumers have tried the incandescent light in order to keep everything in good order, that they had to adopt the use of steam heat, and have put in the incandescent light so as to avoid the blackening of the ceiling; but, notwithstanding that fact, the house was as black at the end of the season from the steam heat and electric light as it ever was with the use of grates and the use of gas. Wherever the radiator stood a column of heat went straight to the ceiling that carried with it all the particles of soot and dirt and dust which lodged directly over it, and wherever the wires ran there was lodged a coating of black from three to six inches in width the whole length of the room—where these wires were on the fixtures the fixtures were soiled—so I don't see they gained very much by leaving us and taking up with the other fellow. Our company has taken a great interest in the question of burners. We bought a great many, and have supplied everybody with tips, and do so right along, free; and while Mr. Butterworth and Mr. Printz might on going along the streets see in our town some imperfect burners, it is simply because the consumer takes no interest in them, thinking that our man will be along the next day, and he can get a new tip, and he would rather have a new one than to have the old one cleaned out. We keep them in as good order as we can. In nearly all our business places we have driven the incandescent light out, though we will admit that wherever there is a gas jet there must be of necessity a dark spot. It will come there sooner or later. It will come very soon from the heat that is generated from the gas, and which carries the soot to the ceiling directly above. I do not attribute it to the bad quality of the gas. I don't admit that. I don't know that I would even if it were a fact (laughter); but I am satisfied bad gas does not do it.

Mr. Penn—I would like to ask Mr. Cantine if he has tried any of the regenerative lamps?

Mr. Cantine—Yes, sir. We have tried them, and I am not particularly in love with them; they require too much time and attention to keep them in repair. The regenerative type is a good thing and makes a very good lamp, but only a short time elapses before the asbestos covering on the cylinder becomes loose, and as they decline to give us any formula for making that asbestos, so that we could put it on ourselves, therefore, we must keep a stock of them on hand, or we must extinguish the light until we can get new ones. That seems to be a great objection to them. We could very easily repair them, but we cannot keep the asbestos on for any very great length of time.

Mr. Penn—It don't cost a great deal, does it?

Mr. Cantine—Yes, it is quite an item of expense, if you have to buy it; and, like all other items that you can avoid, you want to avoid it if possible.

The President—In connection with this paper, we will take up question No. 9. "Is it possible in actual practice, even with the use of the best street main governors, to prevent the pressure of gas at consumers' burners from fluctuating to an objectionable degree? Or are governor burners the only remedy?

Mr. Douglas—I think governor burners are the best remedy, because a street main governor will, of course, govern the entire city, while conditions vary in the different parts and the regulations can only be done locally.

Mr. Chollar—Mr. Faux's paper, I think, is like a good big egg—it is full of meat and good meat all through it. A few points in it particularly attract my attention. Mr. Faux says, "The gas company determines the quality of the gas entirely which it desires to sell to its consumers. It should then determine to deliver it at the point of combustion in the best practicable manner." I think Mr. Faux might have put it a little stronger. It is only a question of a short time when gas companies will be compelled to do that. They will have to do it or else they will lose business. The electric light companies are paying more attention to that than we do. Another point which has particularly attracted my attention is, "The gas

company should furnish appliances for doing this" (that is, to keep the burners clean). He says that the gas company should furnish appliances to their consumers wherewith to keep their burners clean. Well, the consumer will not do it; the gas company is bound in time to do it. The time is bound to come before many years when every gas company will have to follow the practice adopted by Mr. Butterworth—keep a man to attend to that part of the business. It is getting worse and worse every year. Now, we try to reduce the cost of our gas the one-hundredth part of a cent per 1,000, and we think we are doing a big thing if we can reduce it one-tenth of a cent. But the difference between a good burner and a bad one is three times the price of the gas. I remember a little case that happened to me not long ago. On going into a furniture store, the proprietor complained to me about the quality of his gas. He said it was no good, and that he was going to have electric light. I asked him what the trouble was, and he told me that the gas was no good. Noticing the dirty globe and the bad burners inside them, I went with him and made a test of the quality of gas he was burning. I showed him in two minutes that instead of paying $1.50 per thousand for his gas he was actually paying $21 a thousand. The bar photometer showed just that state of facts—that he was actually paying $21.60 for his gas, and all he had to do was to do something which he would not do. He had used his burners until they were all played out, and had never cleaned the globes; and this, I have no doubt, is the experience of every gas man present—he encounters customers who from not looking after their burners and globes will become dissatisfied with the gas, thinking the trouble lies in the quality of the gas and not in the burner or the globe; and when an electric light man comes along, they will take electric light in preference to gas. We have to establish a new department especially to look after this part of the work. You may call this expense account whatever you will, but the time is coming when all gas companies must not only supply gas, but must supply all the apparatus and appliances and take care of them for the consumer, because the consumer will not do it.

A motion was then carried, extending Mr. Faux a vote of thanks.

Mr. G. N. Clapp, of Middletown, Ohio, then read to the Association the following paper:

THE RELATION OF HOLDER CAPACITY TO OUTPUT.

This is a very important question to determine. Like all other questions in gas manufacture, that of economy is of importance, not only to the stockholder but to the manager, foreman, or engineer also. The question to be discussed is, "What proportion to the output should the holder capacity be?" I have no doubt that if this matter were to be determined by the superintendent or engineer, the holder would be very much larger than it would be were it determined by the directors or stockholders, as the latter would likely determine the question, "How small a gas holder can you get along with?" And that again would be determined by the capacity of the retorts. My own experience in this matter has been varied, and I think I will be able to show that by having a large gasholder capacity there is a great saving of labor and fuel; and a more uniform quality of gas can be produced, both as to purity and candle power. I have made and sent out in 24 hours, with a gasholder of 9,000 cubic feet capacity, 37,400 cubic feet of gas, with a retort capacity of 40,000 cubic feet. But let us see what the result was. It was necessary to make the larger portion of this gas between 6 and 12 P. M., and required one extra stoker. The cost of labor alone was 4¼ cents per 1,000 extra. So that the labor alone would pay the interest on an investment in holder capacity that would be of ample proportions. The way to reach the highest economy, in my opinion, is uniformity both in labor and manufacture. What I mean by this is, if you have 48,000 feet of gas to make in 24 hours, and you can make exactly 2,000 feet per hour, and have a storage capacity sufficient to keep that rate up during the day, it can be produced very much more economically than by having to stop making gas at 7 A. M., and be idle for the want of holder capacity until 5 to 7 P. M., according as it may be in winter or in summer. The expense of maintaining our retorts is considerably less with uniform work. It enables us to keep the retorts clean, and the heat for carbonizing is more thoroughly utilized. Many times, where we are working so irregularly on account of insufficient holder capacity, our retorts become heavily coated with carbon, and we have not the time to clean them out. Hence the loss in coke for fuel. The matter of purification also enters into this question of holder capacity, as so very many gas works are deficient in their capacity for purifying. With gas passing uniformly through the purifying material, certainly very much better results are obtained, whether the purifying capacity be great or small; for I find the purer the gas is as it passes to the consumer the more friends it has, and users will consume more when it is uniform in both purity and candle power. My opinion is that no gas works should have a less holder capacity than its entire maximum output for any 24 hours. This would give uniform work throughout—from the retort to the holder. Then the manufacture could be systematized with great economy and regularity. With the holder full of gas, and no fear of being short, the superintendent and foreman could retire at a reasonable hour and sleep with perfect composure until morning; and instead of dreaming of the holder grounding, the gas going out all over the city, and wondering who would be blown to atoms, or smothered by the escape of gas in their sleeping apartments, he would wake up in the morning and wonder if it would be cloudy all day, so that he could have a large sendout to report to the directors at their next meeting.

Now this question of the relation of the holder capacity to output may be answered quite differently as to large works, where they send out half a million cubic feet per diem. As I have no experience in large works I could not give an opinion on this point, and will leave it to some of our representatives from large cities.

Discussion.

Mr. Faux—I am very much interested in the excellent paper which we have just heard read. My personal experience has been, during my labor in the gas business, that I have always been short of holder capacity. I would not hardly know what to think if I were once placed in a location where I had ample holder capacity. This winter, during some portion of the time, the day consumption alone was equal to the capacity of the holder, and I can assure you I did not feel very good over it. I think it should be a point that the manager of a gas company should try to make his directors thoroughly understand the actual need of ample holder capacity. I think the saving in the cost of manufacture, together with the more uniform quality of the gas, would more than pay the ordinary investment on the amount of capital required to provide that holder capacity. I would very much like to hear this matter well discussed, by some gentlemen who have ample holder capacity, to get some idea what would be the result if a man did actually have ample holder capacity.

Mr. Thompson—I agree with Mr. Faux and Mr. Clapp. Ample holder capacity is an advantage to every department of a gas works. Mr. Clapp has not touched upon the question of the manufacture of water gas, in which, with a smaller holder capacity, and generator capacity equal to the sendout at the time of the greatest consumption, one can get along with a very much smaller proportion of holder capacity to output; but one point in the handling of a coal gas works that he has not touched upon is, as the season advances towards summer it is frequently the case that we have a succession of alternating cloudy and clear days. Along about the first of March you may reasonably expect to have some clear weather. If we drop our benches and have not sufficient stock on hand to provide for any slight additional sendout, we are going to crack our retorts—if we drop our benches and have to fire up again to meet the increased demand—which will be of great disadvantage to us. Take a small works. If it is not provided with two holders, the one should at least in all cases be provided with both inlet and outlet pipes. One difficulty in case of a holder having a single pipe both for inlet and outlet purposes would be in the matter of purifier changes. When the purifiers are being changed the air, which is unavoidably present in the "off" box, will, when the pressure is turned on, be passed out undiluted. If that could be passed through the holder first its presence would be in so small a proportion as to be unappreciable.

Mr. Humphreys—My remarks here may sound a little "trady," but I cannot help it. I think this subject of smoking burners is of particular interest to the Ohio Association. We fully recognize all over the United States that Ohio is pretty well ahead in matters pertaining to the gas industry. That is not said for flattery or anything of the kind, but we mean it, of course. But there is one point in which I do think they are behind, and that applies to the smoking burner question quite as much as it does to the distribu-

tion of the gas. To-day the tendency is for high candle power gas, and not only the tendency, but we have got to give high candle power gas to meet our competitors, and to comply with the demands of the public. That cannot be given beyond a certain point with ordinary coal gas, nor can it be given as some seem to think by enriching the gas with oil. You have not got the proper diluent to enable it to carry the high amount of hydrocarbons present. It is not theory but well-grounded practice which enables me to say that. With a strong admixture of water gas we could carry a much higher candle power, and use the same character of burner and have much less smoke. Now, continuing the same line of argument, in regard to the distribution, Mr. Clapp has very briefly pointed out that if you depend entirely upon coal gas works, we know what the limitations are. The paper shows that very clearly. If you have a water gas plant, it can be banked without detriment to the apparatus, and can be brought up in 40 minutes' time from its banked condition to actual operation, ready to force upon the city the required amount of gas. It is simply a question of having the water gas apparatus there in sufficient capacity. It may interest the members of the Ohio Association to know the condition in which they stand with regard to the water gas question. I recently compiled a quite careful estimate of the amount of water gas being sent out in the United States, and I have no doubt many of the members present will be surprised to learn that over 60 per cent. of the gas in the United States is water gas; and Ohio stands, so far as I can make it out, a little shade below 12 per cent.; therefore, I think I am warranted in taking the ground I do that these two questions are of more importance to gas engineers in Ohio than in any other part of the United States.

Mr. Cantine—I would like to ask one or two questions. I came here to learn. It generally costs me $5 or more to come down here to get a few lessons, and I would like to avail myself of all the knowledge I can secure. The company which I represent have a coal and water gas plant. We find that the water gas plant is a very good thing, when we get short. In from 45 to 60 minutes we can have our water gas plant in full operation, and in 10 or 12 hours we can get 40,000 or 50,000 feet of gas, as the plant is now constructed. You will remember that once I did not feel quite so pleasant about it. Now, Mr. Humphreys—perhaps he would answer the question to you all better than he would to me personally—what percentage of water gas is necessary in a mixture of coal gas to bring it up to a first rate candle power, say 22, and what will be the difference in the quantity used with the varying changes of temperature? In warm weather we all know it does not require as much enriching as it does in cold weather. A few questions of that kind I would like to have brought out. I don't propose to ask them all myself, but I am satisfied that my friend Mr. Humphreys will be very glad to give the information.

Mr. Humphreys—I don't like to take up your time, but the question of the proportion of mixture is almost always determined by the proportion of candle power. You cannot say how much water gas you are going to put in until you know exactly the gas you are going to mix it into. Figure up the candle power and make it a question of proportion, and you will come very nearly the right result. You could come closer of course, if you had an absolutely accurate analysis before you started in, but a much easier way is the "trial and error" system. But the proportion I have stated will be a very good starter for the trial and error system. It will figure out almost correctly. And with regard to warm and cold weather, I would say that that is a question the answer to which must be qualified. If the apparatus is a thoroughly good one, well adapted to making gas from the material at hand, say, for instance, crude oil—and the apparatus must be a very different apparatus from, perhaps, an apparatus that will make first rate gas from naphtha—in warm weather perhaps the inferior apparatus would take the crude oil and make satisfactory gas, or partially satisfactory gas, I would say, but it would not do in cold weather. Therefore, we must state in advance that the apparatus must be satisfactory for the distribution of the gas in cold weather. That being understood, the increased proportion of water gas required for the admixture in cold weather as compared with warm weather, will be extremely small. It is hardly worth considering. At one works under our control, if we should take the old settings that we put in say, 5, 6, or 7 years ago, there is quite a difference; but if we take and compare these results with the apparatus put in later we do not find that difference. There is a shade of increase in the cold weather, but it is very small. I honestly believe that the best gas that is distributed to-day is a well-made water gas. And I believe if I had to distribute gas at the North Pole (which I hope I will never have to do) I would select such a gas. I believe it will carry better than any other gas we know of to-day. I say that advisedly. I do not know whether that answers your question or not, Mr. Cantine.

Mr. Thompson—I am situated very differently from Mr. Faux with reference to the holder question. In the plant of which I have charge, we have a holder capacity of 2,000,000 feet, and for the past 15 days, as between cloudy and clear weather, our output has varied from 1,400,000 to as high as 1,900,000 feet. Our quantity of gas on hand has varied from 900,000 feet to 1,700,000 feet, but we have kept the same number of benches going all the time. We have been able to do that by having that excess of capacity over output.

Mr. Clapp—I anticipated the question of holder capacity for water gas, but as I had some experience in making naphtha gas (and that, I believe, was the first attempt to make gas out of oil, or the lighter oils), I came to the conclusion that we require as much holder capacity for water gas or naphtha gas as we do for coal gas, especially if any one were inclined to attend church on Sunday; as many times we continued to make gas until 12 o'clock on Saturday night. The works were not open on Sunday except merely to keep up the fires. I find, by making inquiry of some of our water gas men, that the best way to deliver a uniform water gas is by having two holders, and then, when the gas is generated or made, to pass it into one holder and withdraw it from that and pass it through the purifiers. You have to have very large purifying capacity if you make such a large amount of gas and pass it through your purifiers.

Mr. Humphreys—I would like to ask the gentleman in what way he made naphtha gas? By what system?

Mr. Clapp—I don't remember the system. It was the generator process; with a superheater, through the ordinary retort.

Mr. Starr—Wasn't it the Gale-Rand process?

Mr. Clapp—That is what it was, the Gale-Rand process.

A vote of thanks was then tendered Mr. Clapp.

Mr. A. F. Nash then read the following paper:

THE PREVENTION OF ERRORS IN READING METERS.

Mr. President and Gentlemen of the Ohio Gas Light Association:

When I received a request from your worthy Secretary to prepare a paper for this meeting, with the above for the subject, my first thought was how little can be said about it; and although I have not been able after reflection to remove my first impression, still I trust I may be able to at least say enough to bring out practical ideas and suggestions from the different members.

Judging from my own experience (which does not include the stamping the position of the pointers on a card) I would say:

1. Have all meters, so far as it may be possible, so situated that they will be easy of access, and in a dry, light place.

We all know that is impossible to have all the meters placed in such a position, still we should insist upon it when it is at all practicable, and with that object in view, direct the plumber where to start the riser. Speaking in a general way, I think the cellar the best place for a meter, provided it is light, well sewered and ventilated, and is kept clean; for the variations of temperature will be less, and consequently the life of the meter longer, and of course easy of access. But if you find your meter in a damp, dark and musty cellar, move it upstairs at your own expense, rather than run the risk of the inspector guessing at the statement when he does not feel like going into a dark hole, or cannot get through the trap door. Where it is not considered best, or conditions will not allow the meter being placed in the cellar, I would suggest in stores a location a short distance back from the front window, near the floor, next to one of the side walls, and protected by a box which can be easily moved aside, either to read or remove the meter. In dwellings, I think the front hall a good place, either in the closet under the stairs or protected by a neat box. We have a consumer who had a very handsome box made of walnut with a hard maple panel in the door. That man always knows just what his gas bill will be, and, of course, is one of the best satisfied consumers we have. The meter being easy of access for the inspector, is also easy of access for the consumer, and consequently he is more likely to

make himself familiar with, and have more confidence in, the machine.

2. Having the meters situated as favorably as possible, employ an intelligent and careful man to read them. Equip him with a lantern to facilitate his movements in dark cellars and passages, and to avoid by its aid the use of matches when the meter dial is indistinct. Also furnish him with a route book showing the statements from month to month, which will enable him to keep a check upon himself as he reads, as well as to be able to give any consumer information if he requests it. See that he has patience and good control of his temper, and do not require him to do more work than he can do thoroughly and well. If for any reason he cannot see a meter, let him so report, and if you think best to estimate the amount, mark it as an estimated bill and explain it to the consumer. You will then hear less of the man who "Turned off his gas for a month but his gas bill came in just the same."

The practice of employing men who are carless or incompetent as meter inspectors, is, I think, a mistake, and one that any gas company will find an expensive one in the end. It is much easier to avoid making an error than to correct one after being made, to say nothing of the effect it has on the consumer, who is only too ready to remember our faults, and probably relate his grievance to his neighbor.

Of course, the most careful will at times make mistakes, and the absolute prevention of errors is hardly to be considered human, still I think if the above precautions are observed, the number of errors in reading your meters will be so few, that you will have little trouble in correcting and explaining them.

Discussion.

Mr. Lathrop—As Mr. Nash says, it is a pretty hard thing to tell how to prevent errors. I think nothing but a strictly honest and a strictly accurate reader can prevent them. I would differ from the author in regard to giving the meter reader the route book, with the last reading in, for the reason that we do not like our meter readers to give the consumers any information in regard to their accounts (except the reading of the meter at that time), or assist the consumer in figuring out his bill from preceding bills, because the man who reads the meter is not, as a general thing, able to make accurate mathematical calculations, and is very apt to err if he attempts such a thing. In one case where the meter reader did figure out the bill he made a mistake of several dollars in the consumer's favor in his calculation, and we never could convince the consumer but what we had "doctored" the bill up at the office, and he was never satisfied with it, and is not to-day. I think, possibly, that the experience of the gas companies in Chicago during the last few months would show the advisability of giving the meter readers no more data to go by than can be helped.

Mr. Allen—One sentence in the paper just read particularly attracted my attention, and that was, "In dwellings I think the front hall is a good place for the meter, either in the closet under the stairs or protected by a neat box." I have no desire to detract from the general excellence of the paper; but my experience is that gas companies have very few rights that anybody is bound to respect. As a rule meters will be placed where they are the most out of the way, and the inspector must be able to read a meter correctly whether he is standing on his feet, lying flat on his back or standing on his head; and he wants to keep in a good humor about it, too. I would draw the line on good humor only when the meter is in the closet under the stairway. A good many of us here have had more or less experience in taking statements, and we know how it is ourselves. The inspector, on his regular monthly pilgrimage, calls at the consumer's house on a muddy day. The lady of the house meets him at the door, and looks so very hard at his feet that he drops his lantern and his route book and takes off his overshoes, and, though his boots may be perfectly clean, he carefully wipes them on the doormat, and, picking up his lantern and book, the lady watching him at every footstep to see if he leaves a mark on the carpet, he enters the hall and reaches the closet door. He opens it, and what a sight there meets his gaze! Old clothes of every imaginable description -of all sizes and in any quantity; old coats, pants, vests, old dresses and other articles of ladies' wear—(laughter)—with names no man can tell; old hats and caps and boots and shoes and broken umbrellas.

Mr. McCook—"And other assets." (Laughter.)

Mr. Allen—I see that the gentleman has been there. The meter is invariably away in the front end of the closet, right where the stairs comes down to the floor. The inspector crawls in between the two lines of clothing hanging on either side of the wall, and stumbles over an old fender or valise. Grabbing hold of something to keep from falling, he pulls down on himself an avalanche of the aforesaid old clothes. About that time he begins to whistle the "Sweet By and By" to keep from getting mad. He carefully hangs up the fallen dry goods and takes a fresh start. He climbs over a trunk, and down comes his foot into a piece of cracked crockery. Getting out of that scrape, he bumps his head against the stairs. Then he quits whistling right there at that point. He gets down, takes his statement and puts it in his book, but in rising, somehow or other, he gets himself inside of an old hoop-skirt, and with the book in one hand and the lantern in the other he can hardly extricate himself. Then is when a man has a right to swear, and he ought to do it. I think there is not much excuse for an incorrect bill being presented, if due care is taken by the Secretary and his force. We insist upon our inspectors in each case taking the statement, putting it in their book, and then carefully taking it again, and looking to see if the book is correct. The bills are made out from the route books, and the figures in the statement book are made out from the route books, and afterwards the bills are compared with the statement. The bill clerk in making out the bills, or rather in making up the statement book, is expected to watch closely, and if there is any unusual variation in any particular bill, to call attention to it and we again read the meter. By this means I do not think there is much danger of an incorrect bill getting outside of the office. As long as we keep them inside the office, they don't count.

Mr. Humphreys—I might refer to one matter which may possibly help some gentlemen with small works, although you may say it is an old idea. In one of our works where they used the "dollar and cent" meter, some trouble came up in connection with it, and the Superintendent, before taking a statement, prepares all his bills in blank, and these bills are taken right to the consumer's meter, and on the face of the meter marks are made right against the hand in every case. I do not know of any man with any system who has less trouble with his consumers than that man. You can readily see it must be quite accurate, and of course in a small place of 300 or 400 consumers, it would be a very good plan. I would like to raise a note of warning against putting a meter under the platform of a front shop window. You know they very often shove the meter under there. A very serious accident from a case of that nature came within my notice not long ago, where a door was made in the platform, in order to get access to the meter. The man had to go in to disconnect something, for some reason; he got in there, and the men in the store noticed, after a while that he was not moving. He had gotten in there and gotten ready to make the connections when, for some reason or another, he could not make them, and was pulled out of there a dead man. The door was quite small, so that he could just get his head and arms in the door, and the casing formed a tight band around the upper part of his body and chest. Such cases are, I believe, liable to happen all over the United States, unless proper precautions are taken.

On motion a vote of thanks was extended to Mr. Nash.

Mr. W. H. Anson, of Columbus, Ohio, then read to the Association the following paper:

SHOULD GAS COMPANIES DO ALL GAS FITTING?

A reply to this question, either in the affirmative or negative, by one who is as unfamiliar as I am as to the manner in which the different gas companies are treating the various branches of this subject, would, I fear, be regarded as too general; and as I have enjoyed but a few years' experience in the gas business, and these few years with but one company, I must, therefore, reply from the knowledge gained by that limited experience and observation, and from an entirely local standpoint.

This same question, practically, was one found in the "question box" at the meeting of the American Gas Light Association, in Savannah, Ga., in October, 1890; and before replying directly to this question I wish to say something, by way of preface to my paper, in reply to some of the gentlemen who discussed this question at that time.

One gentleman thought there were no good reasons for so doing. Gas companies would be obliged to carry a large stock of useless

material, and would have a great deal of waste; should have nothing to do with it except where necessary to secure or retain a customer, in which case it might be well to follow the plan.

As to gas companies carrying a large stock of useless material, I do not think that gas pipe or fittings could be regarded as such; for a gas company that is at present doing the service-pipe branch of the business, must necessarily carry a stock of some six or seven sizes of pipe and fittings, and to do internal fitting would but require a larger stock of the sizes in use at present, and an addition to that stock of two, or three at the most, smaller sizes; and such a thing as waste should *never* occur if proper care is exercised.

No great expense is necessarily incurred in entering upon this field, as all companies have shop-room, tools and materials, and nearly all the paraphernalia required.

Another gentleman stated, "It is a matter of locality entirely. It depends upon how you are situated. If you are fighting with some one else, then you had better do it; or if some one was fighting against you, you had better do it."

I think this proposition is a correct one. When a gas company has to fight the municipal authorities, as well as their lighting competitors, they cannot afford to be idle, and should avail themselves of every opportunity to further their interests.

Another gentleman stated, "One reason why we should not do it, is in this simple fact: Most towns will have at least half a dozen plumbers and gas fitters who have a personal interest in securing work for themselves—they are permanent canvassers for that class of work, and you, by leaving it to them, gain a certain amount of interest in their work; and they in return are interested to promote your work. The moment you take it in hand you will antagonize those men."

To reply to this gentleman, starts us from our local standpoint, and towards a reply to the title question.

To say that "most towns have at least half a dozen plumbers and gas fitters," is but too true. "More's the pity" that there are not *more gas fitters* and *fewer plumbers* doing *gas fitting* in all towns. To say that the taking in hand of the gas fitting in general by gas companies would antagonize these gentlemen, is, I think, a mistake, especially as to the plumber, who has nothing to do with the gas company's interests. While the *gas fitter*, who is not a *plumber*, and does nothing but *gas fitting*, is to be sympathized with for his lack of experience in the proper distribution of gas. Mr. E. E. Perkins, in his book on "Gas and Ventilation," says, under the head of "*Concerning Gas Fitters:*"

"'The Household Words on Gas and Ventilation' woulp be far from complete if a notice of these gentlemen was omitted; but the least said about them the better. With very many special exceptions on behalf of individuals who would do honor to any occupation, we have no hesitation in stating that gas fitters have, as a body, hitherto hindered more than helped the progress of gas lighting. Employers and workmen have been equally to blame. High charges, unsuitable material, bad workmanship, and an amount of ignorance—and culpable ignorance, and in some cases both combined, that would be deemed a disgrace to other artificers, have been the common characteristics of this branch of business. A company's enforcing certain rules for pipage is a salutary measure. The mysteries (?) of the art having been exposed and discovered to be closely allied to quackery, serving only as excuses for frequent attendances, perpetual annoyances, injury to property, and very long and questionable bills, have gone vastly to render signs of amendment, and these have been greatly needed."

As it is my intention to answer this question in the affirmative, I must confine myself to this, basing my arguments on my personal and local experience in both the *gas-fitting* and *gas* businesses.

Some few years ago I entered the employ of a gentleman whose sign read, "Plumbing, Steam and Gas Fitting." It was the largest institution of that kind in the city at that time, employing some five or six plumbers and a like number of steam fitters; as either of the other two were qualified to do gas fitting, that is, the mechanical part of it, no *gas fitters* were among the number. Now, I do not affirm that neither of the other two *can* do gas fitting, but they *do not* do it. To ask a skilled plumber or steam fitter to do a job of gas fitting shocks him, and he declines it as beneath his dignity. Plumbers and steam fitters command from $2.50 to $5 per day, while a gas fitter is paid but from $2 to $2.75.

After about two months' experience with, first, a plumber, and, then, a steam fitter, and having learned to distinguish the different sizes of pipes, fittings, and tools at sight. I was, with another apprentice of about the same age in years and experience in the business, taken one morning to a single brick dwelling of about 8 rooms, to pipe it for gas. And after having the locations of the different outlets for lights pointed out to us by our employer, we were left alone to complete our task. The other apprentice, being the larger of the two, assumed the role of "jour." and I that of the helper. The first thing necessary after receiving preliminary instructions was to secure a nice, wide, smooth board on which to draw a plan of the piping as it was to be constructed. After consuming considerable time in searching throughout the premises, the desirable board was finally secured. The "jour." then proceeded to draw the plans, while the helper sawed notches in the joists, in which to carry the pipe. That completed, the helper was then instructed by the "jour." to cut the recesses in the brick walls to receive the piping for the side lights. At this juncture a discussion arose as to the most desirable location for the riser. One thought a stud partition would be the proper place, while the other thought a brick partition wall, further to the rear of the house, would be better. The discussion was not to determine the best point of distribution for the gas, or the most efficient point for the riser, as such a question was not thought of, but to obviate the undesirable task of cutting the brick wall.

A compromise was finally reached in favor of the brick wall, by one agreeing to cut the walls for the side lights, and the other to cut the wall for the riser. And then it was discovered that it was about dinner time, and we adjourned until afternoon. On resuming operations, we proceeded to make our marks in the brick walls. The partition was constructed of both hard and soft bricks and was a nine inch wall. After locating a perpendicular line that contained the greatest number of soft bricks that could be more easily cut, the work of cutting was done from floor to ceiling of first story. To be sure of entirely concealing the pipe when placed in its recess, the recess was made amply wide and deep, ranging in width from two to eight inches, and in depth from two to four inches; and in some few places, where an exceptionally hard brick or a row of "headers" was encountered, the depth of the recess also reached eight inches; for in cutting the wall from the bottom upwards, instead of downwards, the bricks became very badly displaced, and the freshness of the wall also aided in making the task more difficult, and consequently the wall was greatly injured. In fact some of the bricks were removed entirely, and were laid upon the floor to be cut and then replaced; especially was this the case with the hard bricks and headers. Some mortar was found, which had been left by the masons, and after securing some water from a neighboring house, enough of the mortar was remixed to be used in resetting the displaced bricks, and pointing up the ragged edges, using a cold chisel for a trowel. The same results occurred in the cutting of the walls for the side lights, though in a less degree, as the pipes to be placed in these recesses were known to be of a smaller size, and therefore not as much cutting was required. Having completed the cutting, the measurement for the piping was taken; that finished, a view of our marks, and a review of our plans and measurement were indulged in, and everything pronounced very satisfactory. We then reached the shop in time to quit for the day. The next day was consumed in getting out the pipe according to the plans; and having been instructed by the proper person as to the size of the piping to be used, the work of getting out the same met with no particular difficulty, other than the placing of a fitting on the wrong opening, or getting the wrong fitting.

On the morning of the third day the pipe was taken to the house to be placed in position, and then more difficulty was encountered, for some of the pipes were a little too long, while others were too short. To obviate the necessity of returning to the shop to re-cut the pipe, we simply enlarged the notches in the joists on the side necessary and sprung the pipe to fit, and thus made some of the short pipes go in. In some that were too long we made an "S" bend, and thus shortened them. But when they could not be sprung or bent to fit they were taken back to the shop and re-cut.

Having finally placed all the piping, the test was applied and the job found to be leaking; whether the leak was one very large one or several small ones, we did not know, but when a leak was found it was immediately made tight, with gas fitters' cement, and, without searching farther, the test

would again be applied, only to find the job still leaking. This was kept up until the test finally showed the job to be tight. The gas company's inspector was notified, and when that gentleman arrived he pronounced the piping tight, but said the job would "not pass inspection until some badly bent and split pipe was taken out," which had been leaking and was cemented. The inspector's suggestions were followed, and he again called and accepted the work. It took four days to pipe this house.

In those days the "plumbers and gas fitters" were a little more "interested in the gas company's work" than they are to-day, for they invariably called upon the gas company for an inspection.

But now not one-tenth of the gas fitting done by plumbers, steam or gas fitters is so reported, and even when the gas company is called upon for an inspection it is in almost every instance because the person having such work done requires from the fitter a certificate of inspection from the gas company.

The foregoing detailed account of a job of gas fitting is given to illustrate the manner in which gas fitting is treated in a plumber's shop, and to show the manner in which the apprentices are taught or "coached" in this particular branch. The gas fitting, as a rule, is done by the apprentices in the plumber's shop. I might relate more such cases, but they are all so nearly alike that it will not be necessary, especially as most of you, no doubt, have had many experiences with this class of workmanship.

Plumbers are very economical. I have known them to take pipe out of the ground that had been used for water, the outer rust hammered and scraped off, the pipe then rubbed with an oil-saturated rag, to give it an apparently new appearance, and then used as gas pipe. Three-quarter inch pipe will, sometimes, be so filled with rust and sediment as to be hardly larger than three-eighth inch pipe in the bore.

Sometimes a job of gas fitting is of such insignificance to the plumber that he will decline to take it, on the plea "that he has so much of the other branches to do that he can not spare the time."

When large buildings, such as an apartment house, church, theatre, public institution, dwelling or factory buildings, etc., are to be erected, estimates on the plumbing, steam and gas fitting are called for. The plumbers will then sometimes form a combination and raise their estimates so high that the building project will be abandoned.

In the erection of dwellings, sometimes the plumber will agree to do the gas fitting for a little or nothing, in order to secure the plumbing or whatever other work there may be. In that case, what is the result? The apprentices do the work, and you get very bad workmanship and unsuitable material.

Gas fitting, in a plumbing shop, is always the last thing. It is so considered and treated, and you will almost invariably read it last on the signboards.

It is the deplorable lack of instruction and supervision that is given to the gas fitting workmen that is primarily responsible for so much imperfect gas fitting. After a fitter has completed his term of apprenticeship with a plumber he should at once connect himself with a gas company, there to find that he knows little more than how to cut and thread pipe and screw it together. There is where the gas fitter gets his first experience in complaints, such as trapped or too small services, trapped risers and house pipes, bad light, pipe too small, bills too large, and a vast number of other annoyances.

A gas company knows what is essential to promote and better its own interests through the care of its principal tributary—the consumer—while a gas fitter does not. The "complaints" that go to the gas company's office never go to the plumber's office.

Sometimes the architect or builder, or both, are at fault, in a measure, for the imperfect gas fitting done by plumbers. The architect will require the gas fitting to be done in compliance with the rules of the gas company; the contractor, or builder, to whom the architect's specifications will be issued, will have a practical knowledge of the general construction of the building, such as the carpentering, masonry, etc., but, generally, has no such knowledge of the plumbing or gas fitting, and consequently these branches do not receive the proper supervision that is accorded the others, and the requirements of the contract are not fulfilled. In the erection of apartment houses or flats, no provisions are made for supplying artificial gas as a fuel; and as no other fuel will be permitted, what are the results? A gas stove is to be set; the pipes in the room in which the stove is to be used are too small for supplying the stove; then it is necessary to reach another point of supply, which is generally at the meter, where the piping is larger. The meter is in the hall-way, some distance from the stove, and it is necessary to traverse the hall-way, injure the building by cutting through partitions, and have an unsightly pipe in a conspicuous place in the hall way. The occupant may vacate the flat and remove the gas pipe he had put in, "but the scent of the rose will cling to it still." The next tenant would be obliged to go to the same trouble and expense. At any rate, the neglect of this particular point is of some consequence to the owner of the property, the tenant and the gas company. The same can be said of the piping of an ordinary dwelling house; which is being done practically the same to-day as it was in the earlier days of gas fitting, and this, I think, tends to retard the progress of the introduction of gas stoves and gas appliances.

There are a few large residences in this city that are so imperfectly piped that when a special occasion requires the lighting of the gas throughout, the gas company is called upon to make an examination beforehand, to see that sufficient light can be had. On one particular occasion a three-story dwelling was to be lighted from top to bottom, and the gas company was called upon to make an examination. The day preceding the event the company made its visit, and found service and meter in proper condition, but the lights were very small. The burners and fixtures were all overhauled, with very little improvement. Two large services supplied the house, one for illumination and the other for a gas range. As the time was too short to repipe the entire house, something else had to be resorted to, so a pipe, the same size as the service, was extended from the meter back through the basement wall to the rear of the house, and then a hose extended from this pipe to the top floor, on the outside of the building, putting a fitting in the hose at each floor, and attaching a smaller hose to this fitting, carrying the hose through the window and attaching to piping in the ceiling, over the fixture in each rear room. This being done at each floor, gave a good supply from the rear, and overcame the difficulty. This plan would be rather an expensive operation to resort to on every like occasion, but if it were not done it might cost the gas company a consumer.

A large manufacturing establishment erected new factory buildings in this city during the past year, and solicited the gas company to do the gas fitting for them, saying "they had experienced the results of the incompetency of plumbers, by the insufficient light in their old quarters, caused by imperfect gas piping, and thought the gas company would be the proper persons to do this work." They did not care to award the gas fitting to the plumbers. The gentlemen were informed that the gas company had entered into an agreement with the plumbers and gas fitters, under which neither was to encroach upon that part of the work which belonged to the other, the company confining itself to the service work only; and that while the company would like very much to comply with the gentlemen's request, it felt in duty bound not to break faith with the plumbers and gas fitters (though, by the way this compact was never observed by the plumbers).

The gentlemen greatly regretted this state of affairs and requested the company "to furnish plans and specifications for the piping of their new buildings." This the company did, and the plans were accepted, and the piping was done accordingly, practically under supervision of the gas company. These buildings contain some 700 lights.

Another instance, but showing more of the "combine" element, as an argument in favor of our affirmation, transpired in the piping of a church, The edifice was erected some years ago, and before gas mains were laid in that district, and consequently had never been piped. When the gas mains were finally laid, the church people wanted gas; a gentleman called upon the gas company and said that he had visited the gas fitters to obtain the lowest possible estimate on the piping for the church, and the estimates were so very much higher than his calculations that he had about concluded not to have the work done, when he thought "the gas company might be able to do the work."

This gentleman was also informed of the agreement then existing between the gas company and the plumbers. But he accepted a proposition of the company "to send an agent to him, to give him an estimate on the piping." The estimate given by the company was a little more than one-half what had been proposed, or estimated, by the plumbers, and was not

figured at cost, nor less, to the company. The gentlemen then secured the services of an idle fitter, purchased his material, and, for the occasion, went into the gas fitting business himself, and had the piping done very reasonably, and in conformity with the gas company's instructions.

A prominent merchant of this city recently committed himself on a point bearing on this subject, which statement inadvertently appeared in the public print. He thought "that gas companies should, by all means, attend to the placing of all gas pipes, and should employ nothing but expert workmen to attend to leaks, repairs, etc., and should give all such cases their immediate and close attention." This, coming to the notice of the gas company, they, of course, supposed the merchant had failed to receive proper attention on the occasion of some complaint at some time. The merchant was then called upon for the purpose of investigating any such neglect or improper service on the part of the gas company. He said he had been asked his opinion on a subject relating to the gas company and the municipal authorities, and did not know that he was being interviewed for publication. That during the conversation he had made that statement, because of the fact that he had, on an occasion, called in a plumber to make some alterations in the gas piping, and to repair a leak; and that the more the leak was repaired, the larger it seemed to grow, and that the work done by the plumbers was very unsatisfactory. That was why he had made the statement, and not because the gas company had failed to do its duty.

During the past summer some plumbers had been called into a hospital, for the purpose of making some alterations in the gas piping, and after turning off the gas at the meter, a pipe was found from which they could not turn off the gas. The gas company was called upon to turn off the gas at the street. The gas company sent their agents to the premises, and after an investigation discovered a three-quarter inch pipe, which, upon being traced, was found to be about 80 feet in length, passing through several rooms in the basement; the ceiling of one room had been plastered after the pipe was laid, thus concealing it. However, the pipe was finally traced from end to end. One end was connected to the service, and the other was found to be plugged with an ordinary cork. This pipe was immediately removed. Had the cork fallen out of the pipe, and an accident resulted from the escaping gas, in all probability the gas company would have suffered both a loss of gas and a lawsuit.

Very recently a number of lights were found in the basement of a store, which were being supplied from the service pipe which supplied the living apartments overhead in the same building. Plumbers had also done this work.

When the steam-fitter, constructing the heating apparatus, the plumber, constructing his various appliances, the fitter, constructing the fire sprinkling apparatus, encounter the gas piping in their path, they do not conform to existing conditions and alter their piping accordingly, but they displace the gas piping by bending, prying or changing its course and position, and take right of way for their respective pipes. But should either the *plumber*, *steam*, *water* or *gas fitter* encounter the piping of the *plumber*, *steam* and *water fitter*, he will adapt his piping to the conditions and alter his own plan. An instance of this character has occurred during the present month.

Our gas company at one time canvassed the houses lying within gas districts that were not using gas, for the purpese of ascertaining the reason thereof. Various reasons were assigned, but principally because the houses were not piped, and because gas was thought to be too expensive. The gas company then gave the proper persons estimates on the piping, and explained to the occupants that gas was not expensive. This move resulted in the gas company piping a few places, and gaining a few consumers, among them some small stores. Why had not the plumbers and gas fitters secured this work?

The gas company knows, and the plumber does not, whether there are two main pipes in a street; whether there is but one and where it is located; whether in the street in front, or in the alley in the rear of the premises, and the size of the mains.

The gas company knows the proper manner in which a building should be piped, whether it is at an altitude above, or below the gas works; whether to place a riser in an outside wall, where it is sure to freeze in winter, or in an inner wall where it will not freeze, and where the point of distribution is most central.

A gas company pays very marked attention to the manufacture of its gas, and it is always adopting improved means and devices for the improvement of its product. It should pay just as much attention to the proper distribution of the same. In other words, I think a gas company should watch the course of its gas from the retort to the consumer's burner, and give the distribution as much close attention as it does the manufacture.

I regard the manufacture and sale of gas as a commercial pursuit, and I think it should be so treated by a gas company. If you do not make an effort to sell your product, who will? The wholesale merchant has his agents; the retail merchant has his through the advertising mediums, and the average gas company at present has its advertisement through its product only.

Because one man burns gas, is no reason why another should, or will; but he should be induced to do so; and a strong inducement would be to see that he has his premises cheaply and proper piped, his service pipe amply large and meter correct, good fixtures and in good condition, proper kind of burners for his locality, and the quality of the gas good.

The taking in hand of internal fitting by gas companies would, I think, have a tendency to decrease, instead of increase, their liability for damages because of leaks, explosions, etc., for by doing so they can greatly improve the character of the work, thus lessening the chances of accidents. Many accidents have been caused by carelessness on the part of plumbers, and very few are caused by bad work on the part of the gas companies.

Damages have been recovered by individuals from gas companies as the result of an accident caused by the ignorance or carelessness, or both, of plumbers, simply because it was the gas company's product which was contained in the pipes. If a gas company is assumed to be financially responsible for all the accidents occurring through the poor work of the professional fitter, then, I think, the sooner they take in hand this branch of their business, the better.

Gas companies should enlist the co-operation of the architect, the contractor, the builder, the owner or agent, and the manufacturer of and dealer in all gas appliances. The co-operation of these individuals with the gas companies would be of more pecuniary benefit to the latter than the combined efforts, as now put forth, of the united kingdom of plumbers. For they, especially the dealers and manufacturers, are sufferers with the gas companies at the hands of the plumbers.

In view of all these and many other considerations, I am of the opinion that gas companies should do all gas fitting.

Discussion.

The President—I will take this opportunity to introduce to you one of our Honorary Members, who will open the discussion on this subject—Mr. Geo. G. Ramsdell, Manager of the American Gas Company, Phila., Pa.

Mr. Ramsdell—Mr. President, I am obliged to you for this kind introduction. I was made an Honorary Member of this Association, I believe, at Dayton, some years ago, and I am sorry to say that this is the first opportunity I have had of attending its meetings from that time to this. I have read all your proceedings very carefully, and with great interest, and have always taken a great deal of pride in the fact that I am an Honorary Member of this Association. I am very much impressed with the papers read here this morning, and especially the last one. I think the subject is one of very great importance, particularly to those conducting and operating small works. I have much of the same experience referred to by Mr. Anson, and I found that the only way it was possible to get relief was in establishing a set of rules and living up to them. I never believed in combining with the plumbers in any sense of the word, and the more rigorous the conditions that they were subjected to the better were the results obtained. I think unquestionably we will always have more or less trouble in enforcing such rules, but if the public are once aware of the fact that you will not set the meter until you have tested the pipes and given to the plumber a certificate a very large part of it will disappear. The great difficulty is in getting the public to understand this; but persistent work in this direction, and distributing occasionally with your other literature a paragraph that refers to this subject, will help very materially, and secure better results for gas companies. Personally, I have been in the habit of doing a large part of this work, under just the conditions I have been mentioning—where somebody desired the work done by the gas company, because they thought that they would have it done right and properly—and always with good results. It created some antagonism between the gas company and the plumbers; but the plumber has done a dozen wrong things, that he has not been censured for, where the gas company has done one about which the plumber has had any just ground of complaint.

Mr. Penn—I am most decidedly in favor of gas companies doing their own gas fitting. My experience has been a good deal as Mr. Anson described in his paper. The plumbers will not take sufficient interest to do the fitting properly. I know of instances where we lost good customers because of imperfect gas fitting. When piping a new house they never report to us, or have us come and test it. If they do, oftentimes after it is tested they put in a little additional piping, and, thinking it is a small matter, do not call on us to test it at all, but let it go. We encounter considerable trouble in getting the plumbers to put in large enough gas pipes. One hotel I have in mind, where the bill averages about $20 a month, and I am satisfied we might just as well sell $50 worth of gas in that hotel every month as $20 worth; but the pipes are not large enough to furnish the gas. The result is that they don't have it all over the house. They can only use it in the dining-room and bed-rooms, and cannot use it in the office and other parts of the hotel, because of these small pipes; and as it is, they have nothing but little gas flames, not the larger ones that Mr. Starr speaks of. The only question that seemed to be objectionable in this respect is one that I think Mr. Anson has cleared up satisfactorily, and that is regarding to the responsibility of gas companies with reference to any accident that may happen. It seems to me if it is the case that every gas company is responsible for its gas after it passes the meter, for any explosions or accidents that may occur, that is still a better reason why the gas companies should do the gas fitting; because then they will see to it that it is done right.

Mr. Starr—My experience on this subject has been that if the gas company does its own fitting the work is much better done. I

think all gas companies should make it a rule never to allow anything else than a three-inch pipe for street purposes, and not allow the use of the quarter-inch pipe. Another course which I pursue in doing the fitting is, if a good man wants the company to put in the piping, but is not able to pay, we give him time. I have given some men as much as three years' time to pay for their gas fitting. The result is that we have our gas very generally distributed all over town. Our town is small but we have quite a large number of consumers in proportion to the total population; and, having that large number of consumers, of course, we must necessarily have some small ones. Yet it is the best thing to have them all supplied; and it is the proper practice, I think, for the gas company to do its own fitting.

Mr. Anson—I would like to reply briefly to Mr. Ramsdell, and also to Mr. Starr, in reference to inspection. Orders for inspections, I will say nine times out of ten, are given after the house is completed and ready for occupancy, so that there can be no thorough examination whatever of the piping; and as to the code of rules requiring a certain size of pipe, we have barred the quarter inch pipe. We allow no quarter inch pipe whatever, provided we see it; but we don't know what is behind the plastering sometimes. I would say that there were several details which I might have mentioned in my paper, but I will speak briefly of one incident which comes to my mind. There was a very large residence piped here two years ago, and I was called on to inspect it after it was plastered. It was a house containing in the neighborhood of 15 or 16 rooms, and my inspection disclosed the fact that the riser was three-quarter-inch. I chiselled two or three holes out around the side lights and discovered the pipe to be quarter inch, and after testing I found it leaked badly. I waited upon the contractor and he displayed his specifications, and the contract was found to require that the gas fitting should be done according to the rules and regulations of the Columbus Gas Company; whereas, these had never been complied with in one iota. I visited the owner of the premises, with the result that the piping was torn out, and it cost the plumber considerable money to repair the damage. I discovered another house being piped by the same man, but the discovery was made before the building had progressed so far. The plastering had not been started; nothing but the lathing. I found the same state of affairs existed there—a number of lights on very small pipes, very poorly put in. There were a number of traps, and I had them all taken out. But we cannot give the inspection of the building the proper supervision until we can compel the plumbers to notify us in time to make a thorough and complete inspection; and I don't know whether without legislation we can compel the plumber or anybody else to do that—so that the only way out of the difficulty I think is to do it ourselves.

Mr. Ramsdell—We require the plumbers to have the inspection made before the pipes are covered.

Mr. Anson—That is our requirement also.

Mr. Ramsdell—Of course if you leave it until the house is plastered you cannot do anything towards inspecting it; but if all the pipes are left exposed, so that they could be examined as to size and thoroughness of work, then, an inspection can be made. Another examination we ought to make is to see that they are perfectly tight. The only weak point about it is that no test is made after the fixtures are on. We would like to have that done; but as that was found to be a rather impracticable thing, it was therefore dropped. The other requirement I speak of we insist upon enforcing.

Mr. McMillin—Suppose they did go ahead and plaster the building before they notified you to inspect it, what would you do?

Mr. Ramsdell—We would not put a meter on; and we find after we have refused two or three times to put meters on we have had no trouble about the notification. The plumbers would not dare to go ahead and ignore it.

Mr. Phillips—I find the same trouble at our place that has been spoken of here. We are a little differently situated, as there are two companies in our place. The city has provided a set of rules, but it is not able to enforce them. If it tries to enforce this inspection rule—that the house is to be inspected before the pipes are covered—they say: "We don't care whether the city furnishes the gas or not; if it don't do it, we will go to the old company," and the consequence is that the house is furnished without inspection almost nine times out of ten. Sometime ago I inspected a house consisting of 15 or 16 rooms, and found that the riser was only three-quarter-inch, and that the pipes were leaking, as Mr. Anson said. I sent for the plumber. After looking at it he said, "That pipe was tight when I left it, and if you don't want to make it tight, you can let it go; I have got my money for the job." The consequence was that the meter man and myself took up the floor, inspected and repaired the work, and made it tight at our own expense. I believe in gas companies doing the work. I am a practical fitter—learned my trade in Dayton and served my time with the late Edward Gwynn at gas works building years ago, then went with him (in '56) to build gas works at Tiffin, Norwalk, Springfield, and Marietta, Ohio, at Jacksonville and Springfield, Ills., and other points. I believe the gas companies ought to do the gas fitting, and do it as near cost as possible. By doing that they will get better results. They get large pipes which we all know are required to secure the best results, and then we will not have the complaint from your customers, which you will otherwise encounter.

Mr. Thompson—I fully appreciate the position which Mr. Phillips says he occupies, where there are two companies operating the same territory. Either one wishing for the business, will disregard the rule of the other, and indirectly its own rules; but in the case of a single company operating in a district you can secure the cooperation of the architects, by requesting them for their own protection to allow no estimates for gas fitting unless the bill of the plumber is accompanied by a certificate of inspection from the gas company. We require practically four inspections: One before the pipes are covered by the plasterer an inspection of pipes and a pressure test; one after the plasterer is done; then a pressure test; and, lastly, a test after the fixtures are placed. Wherever the pipes will not stand the pressure test, we require a release in writing from the owner of the building from all reliability by reason of defective lighting or accident, which may be traceable in any way to the fact that the pipes will not stand such pressure test.

Mr. Starr—We have a standing notice published in the papers that any parties having gas fitting done cannot have the gas turned on until they present a certificate of inspection from the gas company's inspector; and often when we find a house being built, where it is the intention to consume gas, we send a notice to the owner of the premises requesting him to see that the pipes are properly tested, and that a certificate is secured.

On motion a vote of thanks was extended to Mr. Anson for his paper.

On motion the Association then adjourned until 2 P. M.

SECOND DAY—AFTERNOON SESSION.

The proceedings of the afternoon of the second day were begun pursuant to adjournment. Mr. C. H. Welch, of Athens, Ohio, read a paper on

THE PRESENT AND FUTURE COAL TAR MARKET.

Mr. President and Gentlemen: Coal tar is most familiar to us in its crude form—a resultant or by-product from the destructive distillation of coal in the manufacture of illuminating gas. This product, within the almost entire experience of many coal gas manufacturers of to-day, has been a source of great perplexity—yielding very little revenue, and in many places without commercial demand whatever; and further than this, often entailing an expense in caring for it as a private and public nuisance. Primitively, it was made use of for coating iron castings and as a source of inferior lamp-black and a solvent oil; later, it was used for firing benches, for a cheap form of street pavement, for painting and preserving wood and other simple uses.

To-day it discloses a complete metamorphosis. Commercial demands and decreased production have advanced it in utility and value, until it no longer is known as "a veritable Jonah;" and by the aid of chemistry its manifold nature is revealed like a panorama, as beautiful in conception as the colors and dyes which are hidden within its mass.

From the five general constituents which coal tar yields upon distillation—pitch, dead oil, light oils, naphtha and ammoniacal water by further analysis, combination, fractionation and refractionation almost without limit, it now presents a list of over 700 useful, valuable and distinct substances, so many and so rapidly multiplying that the discoverer seems lost for names with which to christen them, and the field of affixes, in the forms of "enes," "ides" and "yls," is well nigh taken up.

It proves to be one of the most wonderful and highly complex substances known—a labyrinth, a world of wonder within itself, and of ever-increasing interest to the chemist.

It is not a long distance chemically from the tar pit to saccharine—the sweetest substance known—from the black, viscid mass to the beautiful and brilliant anilines. But it is probably pitch, which forms over 60 per cent. of the composition of coal tar, that is the prominent factor in governing its natural value; and passing from an aesthetic view of the evolutions of coal tar to within the limits of the subject proper hereof—"the market"—we find prices leading up to and including contracts for tar for the year just closed, altogether abreast with the enhanced position gained for it by science and manufacture.

The prices received for tar in 1891, and paid for by distillers, reached as high as $5.50 per barrel, net, to the seller; and the average net price received for tar sold last year in this State was over $4 per barrel. These comparatively high prices are attributable partially to a panic among distillers, created by the impression that there would be a scarcity of coal tar in the United States during 1891, making sharp competition among distillers for the tar product of that year, and partly to the shrewdness of the seller in holding out for the highest obtainable price. This condition of the market was at its height just following the enactment of the McKinley law, which removed the tariff from the imt portation of coal tar and pitch, putting them both upon the free-list on October 6th, 1890. These influences stimulated importation, so that during the year 1891 large quantities of English tar and English pitch were shipped to this country. Hence, to-day we find the country well stocked with foreign tar and pitch, gas company tar wells overflowing, and striking evidence pointing to a remarkable concert of action on the part of tar distillers in the United States in dealing with gas companies, and, as a net result, a series of offers obtainable in February, 1892, range from $2.20 to $1.65 net per barrel, upon a basis of 1,000 barrel lots. So much for the present market of coal tar in Ohio.

As to the future, one shrinks from the task of forecasting events, and especially in a field that plays the pranks and somersaults that tar did in 1891. The chances are in favor of ridicule if an

attempt is made to penetrate the future very far; however, the tendency of the market for the immediate future is for lower prices still.

The question as to what prices will prevail beyond the present year may resolve itself into one of supply and demand. The supply is decreasing by reason of water gas and electricity rapidly taking the place of coal gas. It is estimated that 60 per cent. of the illuminating gas manufactured in the United States is water gas; 12 per cent. of Ohio's output is water gas. Probably electricity has not been a large factor in directly decreasing the output of coal gas, but it has checked its growth. It is claimed by prominent coal gas men in Ohio that coal gas will regain its lost prestige and in turn supplant water gas, owing to the rapidly vanishing oil fields; while to the contrary, even if this be true, oil can be bought cheaper to-day than ever; and where one field is exhausted, another is found to take its place. Witness the oil fields of Wyoming, which it is claimed give promise of abundant yield; and more significant is the part which the oil fields of Russia will probably play in supplanting the coal gas of England, where bituminous coal and cannel are becoming dearer. Water gas yielding very little tar, and when made from naphtha practically none, such a condition would materially contract the coal tar product of England, which now so abundantly comes across the water. On the other hand, and tending to establish the commercial importance of tar, the signs of the times are that the demand for tar is rapidly increasing. Note the vast consumption of pitch, of two and three-ply roofing, roofing cement, tarred straw board, roofing felt, gravel roofing, building paper, paving cement, and all the new, varied and multiplying uses to which pitch, creosote, and the other numberless products of coal tar are being put.

The industry of street paving, which alone consumes immense quantities of pitch, is strikingly on the increase in cities all over the country. The local demand for tar, outside of that used by distillers, is increasing.

The tar distillers explain the demoralized condition of the tar market to-day, and the influx of English tar, by reason of the free tariff law; this is hardly tenable ground when the duty on coal tar, by the act of 1883, was but 10 per cent. *ad valorem*, and on pitch 20 per cent. It is true that English tar is at present imported and laid down at the port of New York at less than $3 per barrel; and will continue to be imported and govern the American market as long as there is a surplus of tar for importation. The annual production of coal tar in the United Kingdom is approximately two million barrels; of the United States, 700,000 barrels; of Ohio, 70,000 barrels.

Whether or not the interest of gas companies could be advanced by the establishment of a general still at some central point for the reduction of Ohio's 70,000 barrels of coal tar and thence to the market in the form of pitch and its various sub-products, is a question worthy of prompt solution. Even in a raw condition, its present position in the market can be immeasurably strengthened by increasing the present storage capacity to two years' output; by acquiring facilities for loading in tank cars; and by adopting measures for handling the State product in large quantities through a common agency.

The handsome income from the tar account of gas companies during last year has given some prominence to this branch of the gas business; and knowledge of the flatness of the present market will cause considerable depression in the minds of those who have calculated dividends on a basis of similar income this year. Such experience by the coal tar producers will arouse inquiry and stimulate interest in this department of gas manufacture; and if the attention is given it that the present situation amply justifies and demands, not only can the effect of the present falling prices of coal tar be largely offset and checked, but the future be forced to yield all there is in a natural condition of the tar market.

Discussion.

The President—Gentlemen, we have just heard a most interesting paper, and I cannot allow the opportunity to pass by without finding fault with Mr. Welch. He has allowed his "light to shine under a bushel." Having been trying for years to get him to write a paper, this is the first one we have been able to secure; but from the excellent results of this year's effort he will have to respond in the future.

Mr. Nash—This is a subject which is of a great deal of interest to coal gas men all over the country. They are watching the markets very closely, and it is to be hoped they will all act in concert and try to secure a better price for their coal tar. If necessary, I hope they will purchase barrels and add to their tankage in order to store it, and in that way be able to get a higher price for it by holding on to it. I think that the coal gas men should unite in trying to bring about a better price.

Mr. Penn—With reference to the combine in the tar business, I was thinking of what Gen. Hickenlooper said at Cincinnati at one time when he was having so much trouble there. He said that the proper way to do was to "fight the devil with fire." I think we should employ the same kind of argument on this subject. If it is true that the large chemical works of the country have combined for the purpose of keeping the price of tar down, then the coal gas men ought to combine for the purpose of keeping the price of their tar so that they will be able to get a reasonable revenue from it. At our place it is quite an item. The tar pays about half of our coal bill. But with tar at the present price I would only count on about 25 per cent. of our coal bill instead of 50 per cent. I think that coal tar certainly ought to be worth more than that, and I believe it will be. I am one of those persons who are going to make another hole in the ground and fill it full of tar.

Mr. Printz—I am one that has already sunk a hole in the ground and got it ready for the tar.

Mr. Faux—You made it for ammonia, didn't you?

Mr. Printz—I made it for ammonia, but I am using it for tar at present. I can say I am one who thinks it is the best policy to hold on to our tar. I believe the time will come when we can secure a reasonable market for it. I know that tar is very low. I find that the prices are away down, as low as $1.70 to $2.10, when before they were running from $3.30 to $4.75. As Mr. Penn has remarked, it cuts quite a figure in our receipts, and the reduced price causes quite a reduction in the net receipts for this year; but if I can see my way clear I expect to store it for a year or two in the hope that the market will rise.

Mr. Padan—This is a subject that is of more interest to our stockholders than anything else that has come up to-day. Our well is full, and although it is easy to talk about digging another one, that will cost a good deal, and when it is finished the tar may be still cheaper. Some one here ought to know enough about this subject to give us an idea by which we could regulate our future action. Certainly some one here has handled tar and is familiar with this matter. Mr. Welch has bought and sold a good deal of tar, and I hoped he was going to advance the market before he got through with his argument, but he intimated it will probably be still cheaper. Then another man thinks we ought to hold on to it and the probability is we will go home and sell it for whatever we can get for it. If there is any other way which has not been mentioned for the disposing of this question, I hope it will be spoken of. He speaks of establishing a general still in Ohio, as one way out of the problem. I hardly think such a thing is practicable. Ohio can furnish a good deal of tar in a year or six months, and the still would have to be very large, or we would be in the same fix we are in now.

The Secretary—Wouldn't it be true also that as the price of tar decreases the price of tar products correspondingly decrease?

Mr. Padan—I could not answer that.

The Secretary—It naturally would follow, I should think.

Mr. Padan—This is a very important question to most of us and I would like to see somebody undertake to answer it before the debate closes.

Mr. Clapp—I think I have a solution. A few years ago when we could not sell our tar to advantage we commenced to burn it under our retorts. Wherever we can sell the coke we can burn the tar.

Mr. Penn—I was talking with Mr. Light, of Dayton, at one time about burning coal tar, and he said he could afford to burn it at $2. Of course, if $1.20 to $2 is going to be the ruling price, we had better burn it.

The President—Some one has just sent word to me that one of the smallest gas works in this State has made a contract at $3.75.

Mr. Cline—I understand that Mr. Marden knows something about an outlet for tar at a good price. If he is present, perhaps he can give us some information on that subject.

The President—Mr. Marden always had an eye to business, and perhaps he would be willing to tell us.

Mr. Marden—No, I could not say that I have an outlet for *your* tar (laughter). I make it my business to secure a market for *my own*, and get a good price for it. Mr. Welch says, "It is true that at present English tar is imported and laid down at the port of New York at less than $3 a barrel, and will continue to be imported and govern the American market as long as there is a surplus of tar for importation." This imported tar is not good for roofing. The oil has been taken off—the heavier oils—and it makes it too brittle to be used for roofing. A friend of mine that is in the business has made a test and has pronounced it to be too brittle. They cannot use it for roofing tar. It cracks too easily. In that state of the case I don't think that in a year from now we will have any trouble in getting our prices back to where they should be.

Mr. Cline—I understand that is a fact, but still a large percentage of the tar that is manufactured and sold is used in paving, and this tar and pitch can be used for paving purposes notwithstanding its hardness.

Mr. Marden—That may be true also, but after they take off their tar for roofing purposes they will sell that hard tar to the street pavers; they take their good tar for roofing and then sell what is left for street paving. If they can get good tar here for roofing and then sell it, it would be cheaper for them to do that; and tar buyers and consumers would make more money, I should judge, than they would to import that tar simply for street paving purposes.

Mr. Chollar—I would just like to ask incidentally how the Ohio Association stands on the subject of tar in the McKinley Bill (laughter)?

A vote of thanks was then extended to Mr. Welch for his paper.

Mr. Tayler—Referring to the suggestions of Mr. Welch as to the subject of looking after the coal tar interests, I would move that the Chair appoint a committee to look into the matter suggested by him, as it is a question which is of interest to all, and to gather such information as they may be able to secure, and to report at the next meeting. [Seconded and carried.]

The President then appointed upon that committee, Mr. Charles H. Welch, Mr. Jos. Gwynn, and Mr. J. W. R. Cline.

[*TO BE CONTINUED.*]

A Computation of Joule's Equivalent.

Mr. R. H. Thurston, in a communication to the *Journal of the Franklin Institute*, calls attention to a series of articles, published in that *Journal* some years ago by Dr. Pliny E. Chase, Haverford College, and, having stated that the articles were of singular interest and of curious result, continues: Often he (Dr. Chase) traced what he called certain harmonies of nature, exhibiting some strangely related or oddly coincident physical laws and constants, and in which he deduced a number of remarkable conclusions. He subsequently published a short paper, reprinted in the *Philosophical Magazine*, in which he showed some reason for anticipating that it might ultimately prove that the value of r, the ratio of specific heats of gases, is simply the numerical quantity

$$1 + \frac{4}{\pi_2} = 1.405285$$

(*Phil. Mag.*, 1885, p. 520.)

It occurred to the writer to compute the value of J, the mechanical equivalent of heat, from this assumed value of r. Taking the best values of constants determined by Regnault, referring all quantities to the air thermometer, and taking air as the gas to which the constants so selected should appertain.

From the well-known equations deduced by both Rankine and Clausius, we have the equality,

$$C_p - C_v = R = \frac{p_o v_o}{T_o}$$

or difference between the two specific heats in constant, a fact first pointed out by Carnot, and later proved by the modern methods of thermodynamics by the founders of that science.

Since we take

$$\frac{C_p}{C_v} = r$$

we have

$$C_p = J c_p = \frac{r}{r-1} R;\ J = \frac{r}{r-1} \cdot \frac{R}{C_p}$$

and taking as Regnault's most probable values of C and of R, in British measure, 53.37 and 0.2375, we have

$$J = \frac{1.405285}{.405285} \cdot \frac{53.37}{0.2375} = 778.12$$

in foot-pounds, or 427 kilogrammeters per calorie. This corresponds to about 775 on the mercurial thermometer, falls within about $\frac{1}{4}$ of 1 per cent. of the value assigned to J, by the British Association Committee of 1876, and is somewhat lower than the figures obtained at the temperature of maximum density of water by Rowland in 1880. This determination would seem to lend some color of probability to the conjecture—for it seems to have been little more—of Dr. Chase. In further, and perhaps more satisfactory, confirmation of this, as at least a closely approximate value, as have the work of Dr. Rontgen, who, in 1872, obtained $r = 1.4053$, as a mean of 10 best observations. (*Pogg. Ann.*, 1873, s. 580.) The probably most uncertain datum involved in this computation is the value of R; but it is probable that all these figures are very accurate and the computed value of J must be correspondingly so. Further examination of the value of R, which involves the location of the absolute zero is desirable however.

Magnetic Iron Rust.

The London *Journal* notes that at the recent meeting at Hobart, Tasmania, of the Australasian Association for the Advancement of Science, Professor Liversidge, F. R. S., of the University of Sydney, read a suggestive paper on the rusting of iron. The author remarked that in books upon chemistry it is usually stated that iron rust is composed of the hydrated sesquioxide of iron; but on examining a very large number of specimens of rust from many different places, and from iron articles of various kinds, and formed under very varied conditions, Professor Liversidge has found that in almost every instance the rust contained more or less magnetic oxide. Indeed, in some cases the rust, although presenting the usual rust-brown color and appearance, was, when powdered, practically altogether attracted by the magnet. The specimens of rust which first drew the author's attention to this subject were large rust scales obtained from some old tramway metals, which he was led to collect and examine on account of their resemblance to the crust so often present upon metallic meteorites. On crushing these scales in a porcelain mortar, and testing the dust with a magnet, it was found to be wholly susceptible to magnetism, owing to the small quantity of magnetic oxide present being mechanically inclosed in the rust particles. The production of this magnetic oxide does not seem to have been due to the presence of mill scale, because, when bright iron wire, plates, rods, nails, etc., were artificially rusted in many ways with free access of oxygen, in almost every instance a large amount of magnetic oxide was formed. These observations have some practical bearing upon the problem of the preservation of wrought iron structures from rust.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

At a regular meeting of the Board of Directors of the Covington (Ky.) Gas Light Company, held on the 28th of March, Col. Amos Shinkle, who for 29 years has actively and efficiently served the Company as its President, tendered his resignation. The Directors then elected Mr. Bradford Shinkle to the Presidency. Mr. Bradford Shinkle is a son of Col. Shinkle, and is well equipped by nature and training to acceptably carry on the business so honorably directed by his father during a period well in excess of a quarter of a century.

The Washington (D. C.) Gas Light Company will extend its mains through Jefferson street, between Fillmore and Adams streets, in what is known as the Anacostia district.

On March 28th, on application of Messrs. William W. Potter and Jeremiah M. Watson, Justice Fursman issued an attachment against the property of the Electric Construction Company (the headquarters of which are either at Troy or Albany) to satisfy a claim for $37,477.70 in favor of the petitioners. This is the concern that was concerned in the operation of electric plants at Greenwich, Schuylerville, Whitehall and Keeseville, this State.

We regret to announce the death of Mr. Austin Rust, who since 1863 had acted as bookkeeper for the Plainfield (N. J.) Gas and Electric Light Company. The funeral services were held at the residence, No. 520 South Salina street, on the afternoon of March 29th, the Rev. Mr. Allan D. Draper officiating.

The following action respecting the death of Mr. Rust was taken by the Board of Directors of the Plainfield Company, at a special meeting held on March 26th:

Resolved, That, whereas it has pleased Almighty God to remove our friend and valued assistant, Austin Rust, Esq., we desire at this time and in this manner to express our appreciation of his work which has been so faithfully done; Mr. Rust entered the service of this Company on January 29th, 1863, and remained in its employ until the day of his death. During these 29 years of service he was uniformly reliable and faithful to his duties, and he occupied a place which will not be easily filled. He was a man of strict honesty and integrity, a man whose word was as good as his bond.

Resolved, That the Board will attend the funeral of the deceased.

Resolved, That these resolutions be spread on the minutes of this Company, and a copy sent to his family, and also to the daily papers.

It seems that the Massachusetts Legislature is not entirely satisfied with the report (Senate document, No. 102) submitted by the Board of Gas and Electric Light Commissioners, in response to the inquiry addressed by the Legislature to the Commissioners regarding certain matters connected with the supply of gas to the city of Boston by the Bay State and the Boston Gas Light Companies. At least this is the inference we draw from the motion recently adopted at the instigation of Senator Baker for "additional information" on these topics. It remains to be said, however, that if the Senate did not receive all the knowledge desired by it in the Commissioners' response, it certainly is not the fault of the last named; for, with their usual businesslike procedure they answered fully and clearly all the questions asked; and with their usual judicial methods, did not go into an examination of that to which the Senate resolution did not refer. So, we must consider that if the Senate failed to find out all about everything at the first time of trying, it was simply because the Senate did not exactly know what it did want to know; hence the Senate must bear the burden, and not the Commissioners, of its lack of capacity to formulate a catechism sufficiently thorough. Briefly stated, Senator Baker's elaboration—which seems to be as follows—he introduced the matter to the Senate by means of a resolution adopted on March 29, is: That the Commissioners report to the Legislature within 10 days (1) as to the nature and extent of the business relations between the Boston, Roxbury, Dorchester, South Boston and Bay State Gas Companies, of Massachusetts, and the Bay State Gas Companies of New Jersey and Delaware; (2) as to the cost of the manufacture of gas by the Bay State Gas Company, of Massachusetts; (3) as to

the actual cash cost for land, buildings, machinery and pipes of the plant of the Bay State Gas Company, of Massachusetts, which is assessed by the city of Boston at $630,000, but upon which $5,000,000 of stock and bonds have been issued. For the purpose of this order, the Commissioners are empowered to send for books and papers, and compel the attendance of witnesses.

A ROLLASON gas engine has been installed in the job printing office of the Van Wert (Ohio) *Bulletin*. The proprietors of the latter are very much pleased with its operation, so far.

THE offices of the Vicksburg (Miss.) Gas Light Company have been removed to No. 312 Crawford street, which is one of the stores under the Vicksburg Opera House. The Company will utilize a portion of the offices to display a full line of gas stoves; and the consumers are sure to be pleased with the change. There is no better location for the offices of a gas company than in the very heart of the business district. The rent charge may look steep, but it is not so in reality—rather the reverse. Handsome offices in the best location that can be chosen, are the cheapest and best advertisement that can be obtained by *any* gas company.

THE old buildings of the Stamford (Conn.) Gas Light Company. located on Pacific street, on the east front of the New York, New Haven and Hartford Railroad Company's tracks, are no longer to be an eyesore to the residents of this beautiful and busy Connecticut town. The old structures are being remodelled to suit the purposes of office tenants and the Company announces that the rooms will be ready for occupancy by May first.

WE understand that the proprietors of the Pomona (Cal.) Gas Company have determined to install an electric lighting plant.

MR. WILLIAM CAMERON, Chairman of the Committee on Gas Lights, Petersburg, Va., advertises that tenders will be received to the 30th inst., for not less than 160 and not over 200 arc electric lights, of 1,200-candle power each "and over," and for 100 incandescent electric lights of 20 to 65-candle power each, the same to be located in accordance with specifications, etc., which will be furnished on application. The tenderers are to bid on contract periods of 2, 3 and 5 years, the same to begin on September 1, 1892. He invites special tenders to furnish a complete electric plant, "all put up ready for lighting and guaranteed to create at its minimum capacity ample power to produce (without strain) the maximum number of lights [stated above], and they to burn steadily all night, every night in the year, but to be owned and run by the city." He also calls for a tender to furnish a complete electric plant of the same capacity, put up ready to light, except that the city will agree to furnish all necessary motive power from its own boilers, engines and premises, and that the entire plant is to be owned and operated by the city.

IT was intimated in our last that the proprietors of the Bergen County Gas Light Company, who are in control of the gas supply of Englewood, N. J., would possibly order a reduction in the selling rates, and now we have confirmation of that intention, in that a reduction from $2.80 to $2 per 1,000 has been determined upon, the new rate to take effect on August 1. It is a good, sound determination.

THE Council Committee on Light, which controls the operation of the Charlottesville (Va.) Municipal Gas Works, has at last determined to overhaul the gas mains, the major portions of which have "not been touched" since the works were built—some time in 1860. They are of age beyond a doubt.

WE congratulate Mr. J. H. Findlay, of Ogdensburgh, N. Y., for the finesse displayed by him, which resulted in the securing control of the gas and electric lighting plants at Malone, N. Y. He will act as General Manager of the combination, and the gas works apparatus constructors may soon look out for inquiries from him for estimates, etc. He will virtually rebuild the Malone works. The capital of the combination is put at $50,000.

THE Sage of Pawtucket, R. I., has applied, on behalf of the Pawtucket Gas and Electric Light Company, to the Town Council of Cumberland for permission to supply electric lighting currents in the nearby villages of Ashton and Berkeley.

"OBSERVER," under date of the first inst., forwards the following: "Unless something unforseen occurs the control of the Brockton (Mass.) Gas Company will have passed to-day from the hands of Dr. Wallace C. Keith and Mr. Fred. P. Richmond, and there is no doubt that the trade will be made, as the preliminaries have all been arranged. The controlling interest in the Gas Company was purchased by Messrs. Keith & Richmond a year or two ago, and they have been well satisfied with their bargain. Under their management the service has been improved, mains extended, the plant put in better shape and general prosperity has resulted. Some 3 months ago they were approached by a representative of the American Light and Fuel Company, with a proposition that his Company obtain the controlling interest in the local Company, and the agent finally named a price—I am not at liberty to state it—that was satisfactory to the owners. The plant it is said will be adopted to the particular process controlled by the American Company."

ACCORDING to a certificate bearing date of March 31st, and the signature of Mr. William M. Olin, Secretary of the Commonwealth of Massachusetts, the legal title of the company hitherto known as the Charlestown Gas Company is to be that of the "Charlestown Gas and Electric Company."

MR. FRANCIS A. BACHELLER, of Lynn, Mass., has been appointed Superintendent of the Somerville (Mass.) Electric Light Company. He was formerly in the employ of the T.-H. Electric Company.

IT is likely that a petition for the appointment of a Receiver for the Dubuque (Iowa) Electric Railway, Light and Power Company will result in the appointment of such an official. The Company seems to be in a bad way financially.

THE works of the Clyde (N. Y.) Gas Company were slightly damaged by fire a few days ago.

MR. SAMUEL SHRIVER, a well known and very much respected resident of the Germantown district of Philadelphia, died last Monday. He was 63 years of age, and had been connected with the offices of the Municipal Gas Works, Germantown division, for many years.

MR. HAMBLETON, the thorough-going Engineer of the Baltimore Consolidated Gas Company, is carrying out a very comprehensive and well arranged system of main renewals in that city.

A MEETING of the stockholders in the Columbian Electric Light, Power, Heat and Manufacturing Company, of this city, will be held at the offices (26 Whitehall street) on Thursday next, to consider a resolution passed by the Board of Directors on March 14, recommending a dissolution of the corporation.

A CORRESPONDENT, writing from Salt Lake City, Utah, under date of March 30, says: "You seem to have overlooked—at least I have not seen any mention thereof in your columns—the incorporation in this district of the Union Light and Fuel Company, the objects of which, as set forth in the articles, are to be the conducting of a business for the manufacture of gas from petroleum and the sale of same for light, heat and power, and the sale of gas and oil products in Utah, Nevada and Montana. The Company is to have an existence for 50 years. Its capital stock is $20,000, in shares of $1 each, with a provision to increase the same to an amount that I am not at present able to state—in which quandary I imagine the incorporators are also at present. The officers for the first year are: President, T. R. Jones; Vice President, Hyrum Johnson; Treasurer, W. L. Pickard; Secretary. W. H. Remington. I may have something to add to this at another time."

THE residents of Port Richmond, Staten Island, are very much worked up over the disclosures recently made in respect to the candle power of the incandescent lights furnished under the contract for the illumination of the streets with the concern known as a branch of the Richmond Light, Heat and Power Company. The contract calls for the maintenance of a light not under 32 candle power, but the taxpayers have long been satisfied that the real illuminating value of the lights furnished was far below the specifications and the agreement. A gentleman named Detrick is the ostensible head of the Port Richmond aggregation of electric light suppliers, and he, on the other hand, was loud in his assertions that the lamps were in every respect up to contract. Mr. Van Name, a taxpayer at the Port, believing that testing was convincing, concluded that a photometric examination would answer the purpose better than anything that Mr. Detrick could say, quietly retained the services of an expert. The latter, without notifying Mr. Detrick of either his presence or his purpose, and suitably equipped with a photo-

metrical apparatus, furnished from a well known Philadelphia house, on the evening of March 22d, between the hours of 8 and 10 P.M., tested 7 lamps on the Detrick circuit, with the result that he found the maximum candle value (1 lamp) to be 21.29, the minimum being (1 lamp) 15.21; the average of the whole being 17.64 candles. The sentiment there, now is that incandescent electric lighting is a delusion, a fraud, a hoax, and a movement to abrogate the contract is underway.

At a meeting of the Engineers' Club (held in Philadelphia, March 19, with Mr. H. W. Spangler acting as Secretary *pro tem*) Mr. Paul A. N. Winand presented figures as to the cost of power in using internal combustion engines. He said that the attendance in gas and oil engines is probably not more than in the engine part of the steam engine, and in the newer styles of gas engines, working without slide valve, the amount of lubrication is also about the same, and in a comparison between the two classes of engines these items can be omitted. Considering the question of cost of power in a general way, that is, independent of any combination with other apparatus, gas and similar engines are often cheaper to run than steam. Illuminating gas for power purposes costs all the way from $1 to $1.50 per 1,000. As shown in the Society of Arts trials, a gas engine of about 10 horse power can be run with 22.6 cubic feet of gas per brake horse power. Better results than this have been obtained, but at this figure the cost is 2.2 to 3.3 cents per horse power. This is about equal to 13 to 19 lbs. of coal at $3.50 per ton. Nevertheless, it is mostly cheaper than steam for powers up to 15 horse power, especially when the plant is run spasmodically. When a gas engine is used to generate incandescent electric light, 22 cubic feet of gas will be used for about nine 16 candle power lamps, or 140 candles. The same amount of gas burned as such would give only about 90 candles. The number of lamp hours per year will decide as to whether it is cheaper to burn gas directly or not. In actual work, a gas or oil engine keeps more nearly to its original economy than a steam engine, because a steam engine will run with valves and pistons in bad order, while a gas engine refuses to go if the supply of gas is not about properly adjusted. In an official statistical inquiry as to the economy of power made by the authorities of Birmingham, the fuel consumed was much higher than might be expected from published results of tests on non-condensing engines not being below 9.6 lbs., with an average of 11 lbs. of coal per horse power. Oil or gasoline can be used with about the same efficiency as gas. One gallon of oil is equivalent to 180 cubic feet of illuminating gas, and accordingly it takes about ⅛ of a gallon per horse power per hour. This, at 5 to 10 cents per gallon, is equivalent to 7½ to 3½ pounds of coal at $3.50 per ton. With natural gas at 15 cents per 1,000, one horse power costs about ¼ of a cent, as it takes only about 16 cubic feet per horse power hour, and it would take 3 to 4 times as much gas firing under a boiler for the same power. Using the coal in a producer to make the gas and then using it in the gas engine for power is one way of running a gas engine plant. The efficiency of a gas apparatus is from 70 to 80 per cent. With such an apparatus, a consumption of .935 of coal has been attained in France, and even .883, recently per horse power hour in England.

In the ensuing discussion Mr. Strong said: "One of the most interesting papers I have read on the subject of the cost of power was by Sir William Thompson, in 1881. In this paper the sources of power were divided into four, which were wind power, falling water, tidal energy and coal. The first two of these are directly due to the sun's heat, and, what might at first appear strange, the first of these has had more to do with the comfort and progress of this world than any other power, and it is probable that the time will come again when wind power, in connection with some such apparatus, will again do the work of the world. Tidal energy and water power he regarded as insignificant. The burning of coal he also considered as one of the sources of power which was derived from the sun's energy. Prof. Thomson read a paper in Boston last week, and said that the hope of the electrical engineer was the steam engine, or that the mechanical engineer would produce cheaper power than by the steam or gas engine. Clark says that it is possible to use 40 per cent. of the energy in the coal through the gas engine, while the best steam engine only uses 13 to 14 per cent. The difficulty in the way of introducing producer plants and gas engines is the first cost and the difficulty of starting the engines, but this latter difficulty will probably be soon overcome, and the gas engine will then supersede the steam engine in many cases. We have been engaged in designing an engine which is to make a horse power on 13 pounds of water, and in the boiler we expect to carry 180 pounds pressure, allowing the gas to escape at 250°, and evaporating 12 pounds of water to a pound of coal." Messrs. Coffey and Spangler also took part in the discussion.

Attention is called to the advertisement, inserted at the instance of Mr. George Heil, under which the Board of Gas Trustees, of Wheeling, W. Va., call for bids from contractors for all the ammoniacal liquor produced on the works for a term of five years. The competition closes on the 25th inst.

We regret to announce the death of Mr. R. F. Wilson, a respected and prominent resident of Milton, Pa. His demise occurred at Denver, Col., on the evening of Sunday, March 20th, at which place he had been stopping since last fall, and where he had gone for relief from a lung disease from which he had been a great sufferer. Mr. Wilson was born in Milton, April 22d, 1850, and succeeded his father in the manufacture of patent leather, Mr. Milton, Sr., having been one of the pioneers in that business in this country. He was President of the Milton Gas Company, and also held the same position in the local water company. He was a gentleman in every sense of the term, and, during the time the funeral services were being held (afternoon of March 26th, the Rev. W. P. Breed officiating) every business house in the town closed its doors.

They have a paper in Cincinnati, called the *Post*, whose proprietors are noted for their disregard of facts as these exist, provided the distortion of the facts can be made to serve any personal end. They are opposed to General Hickenlooper—not that that is not to the credit of the General—and as the General is largely bound up in the good name and fortunes of the Cincinnati Gas Company, the *Post* men have paid their malice largely to that corporation. They hired a man who signs himself William L. Dudley, Analytical Chemist of Vanderbilt University, to make a "quiet" photometrical test of the candle power of the gas supplied by the Cincinnati Company, and report the same to them for publication. The "analytical" man reported that, on March 18 and 19 he had, at the Burnett House, tested the gas 4 times, with the following result: Highest candle power, 15.02; lowest candle power, 9.66; mean candle power, 12.05. Then the *Post* printed its little "say" about the "greed; the scoundrellism; the fraudulency" of the Company's practices. Columns were taken up, and the headlines were viscid in their blackness. The General laughed softly to himself, and followed the *Posts* yawping with a simple affidavit from Mr. John Franklin, the Company's Inspector, who, under oath, testified that on the days in which the analytical man from Vanderbilt University said he made his tests the Company's daily photometer records showed the following to be the lighting value of the gas: March 18, average, 16.87 candles; March 19, average, 16.90 candles. The standard value arranged for by the authorities is 16 candles. Oh! Mr. Dudley. What did the *Post* pay you? And where did you take your lessons in photometry? And do you teach the Vanderbilt students to follow your methods?

Manager Marcus Smith, of the Wilkes-Barre (Pa.) Gas Company, will, when the new holder is furnished, rejoice in the possession of one of the best equipped plants in the State. The holder is to be of the two-lift order, and will be guided against 10 wrought iron columns. It is to be 80 feet in diameter, with lifts of 20 feet. The inlet and outlet pipes are to be 20 inches in diameter, and the apparatus is to be finished with all possible dispatch. The betterments already completed are: Four new purifiers, 21 feet long by 14 feet wide, and 4 feet in depth, with 16 inch connections—the covers are lifted and lowered by means of hydraulic power; an 11 foot station meter—a beautiful piece of mechanism from the shops of Helme & McIlhenny—equal to the registering of 1¼ millions cubic feet in 24 hours; and a new boiler house, with two return flue boilers, 6 feet in diameter by 15 feet in length, rated at 125 horse power each. The main leading from the works to Union street, will be taken up and replaced by a 20-inch pipe. Mr. Smith also proposes to put a new 12-inch wrought iron main under the Market street bridge, for the purpose of transporting a supply of gas to the adjoining boroughs of Kingston, Edwardsville, Dorranceton, Luzerne and Forty Fort. Perhaps Mr. Smith is not keeping up with the procession.

Mr. Frederick Jaeger, of the Diamond Lake Ice Company, has disposed of his shareholdings in the Columbus (O.) Gas Light and Coke Company.

Mayor Stuart and Director Windrim urge in their annual reports the great importance of the city's at once acquiring from the present owners the water gas plant from which Philadelphia at present receives a portion of its gas supply. Among other things, the Mayor says: "The control of our supply of gas should forever remain with the city of Philadelphia herself, and should never be surrendered by either sale or lease."

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks,

16 Wall St., New York City.

April 11.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	110¼	110⅜
Central	500,000	50	87	—
" Scrip	220,000	—	95	100
Equitable	4,000,000	100	145	150
" Bonds	1,000,000	—	106	108
Harlem, Bonds	170,000	—	—	—
Metropolitan, Bonds	658,000	—	110	115
Mutual	3,500,000	100	135	—
" Bonds	1,500,000	—	100	102
Municipal, Bonds	750,000		—	—
Northern		50	—	—
" Bonds	150,000	—	—	100
Standard Gas Co—				
Common Stock	5,000,000	100	40	45
Preferred	5,000,000	100	91	93
Yonkers		50	112	—
Richmond Co., S. I.	346,000	50	—	—
" Bonds	20,000	—	—	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	115	117
Citizens	1,200,000	20	104⅜	104¾
" S. F. Bonds	320,000	1000	—	103
Fulton Municipal	3,000,000	100	132x	—
" Bonds	300,000		102	—
Peoples	1,000,000	10	84	86
" Bonds (7's)	368,000	—	100	—
" " (6's)	94,000	—	100	—
Metropolitan	870,000	100	102	105
" Bonds (5's)	70,000	—	100	—
Nassau	1,000,000	25	138	—
" Ctfs	700,000	1000	99	100
Williamsburgh	1,000,000	50	128	—
" Bonds	1,000,000	—	107	110
Out of Town Gas Companies.				
Boston United Gas Co.—				
1s Series S.F. Trust	7,000,000	1000	88½	89
2d " " "	3,000,000	1000	76½	—
Bay State Gas Co.—				
Stock	5,000,000	50	55¼	56
Income Bonds	2,000,000	1000	6	8
Buffalo Mutual, N. Y.	750,000	100	110	—
" Bonds	200,000	1000	95	100
Citizens, Newark	1,000,000	50	155	160
" " Bonds	45,000	—	—	—
Chicago Gas Company	25,000,000	100	76½	76¾
Chicago Gas Light & Coke Co.—				
G't'd Gold Bonds	7,650,000	1000	88⅝	88¾
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1000	—	97½
People's Gas and Coke Co., Chicago—				
1st Mortgage	2,100,000	1000	100	—
2d "	2,500,000	1000	96	—

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DIVIDEND NOTICE.

Office of the United Gas Improvement Co., Drexel Building, Phila., Mar. 25, 1892.

The Directors have this day declared a semi-annual dividend of four (4) per cent. ($2 per share), payable April 14, 1892, to stockholders of record at the close of business April 4.

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By a a man of twenty years' experience. Best of references.

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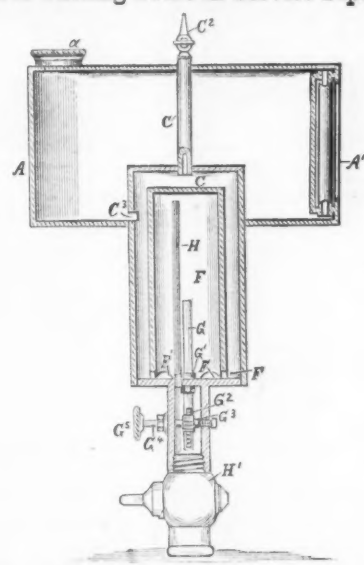

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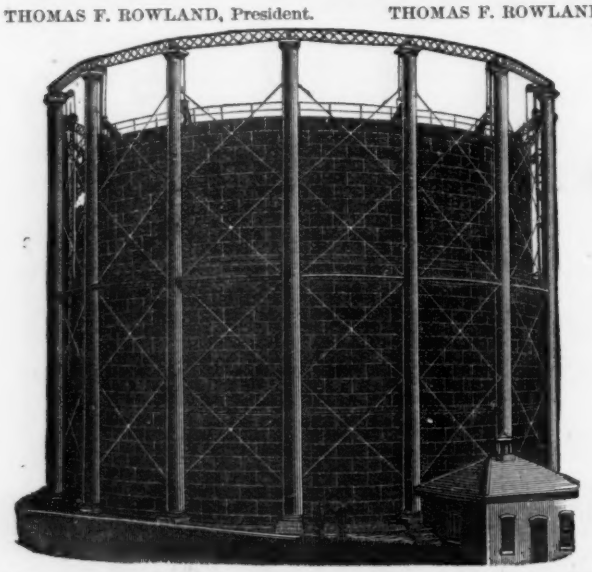

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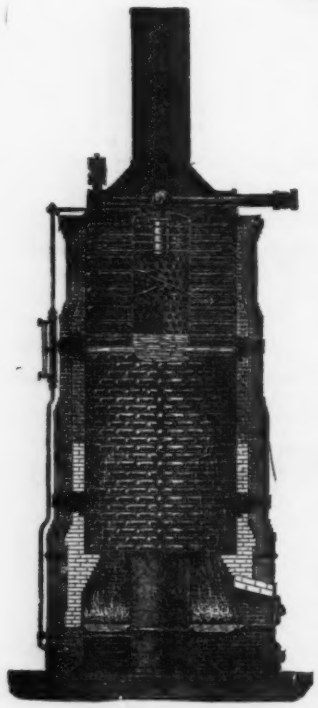

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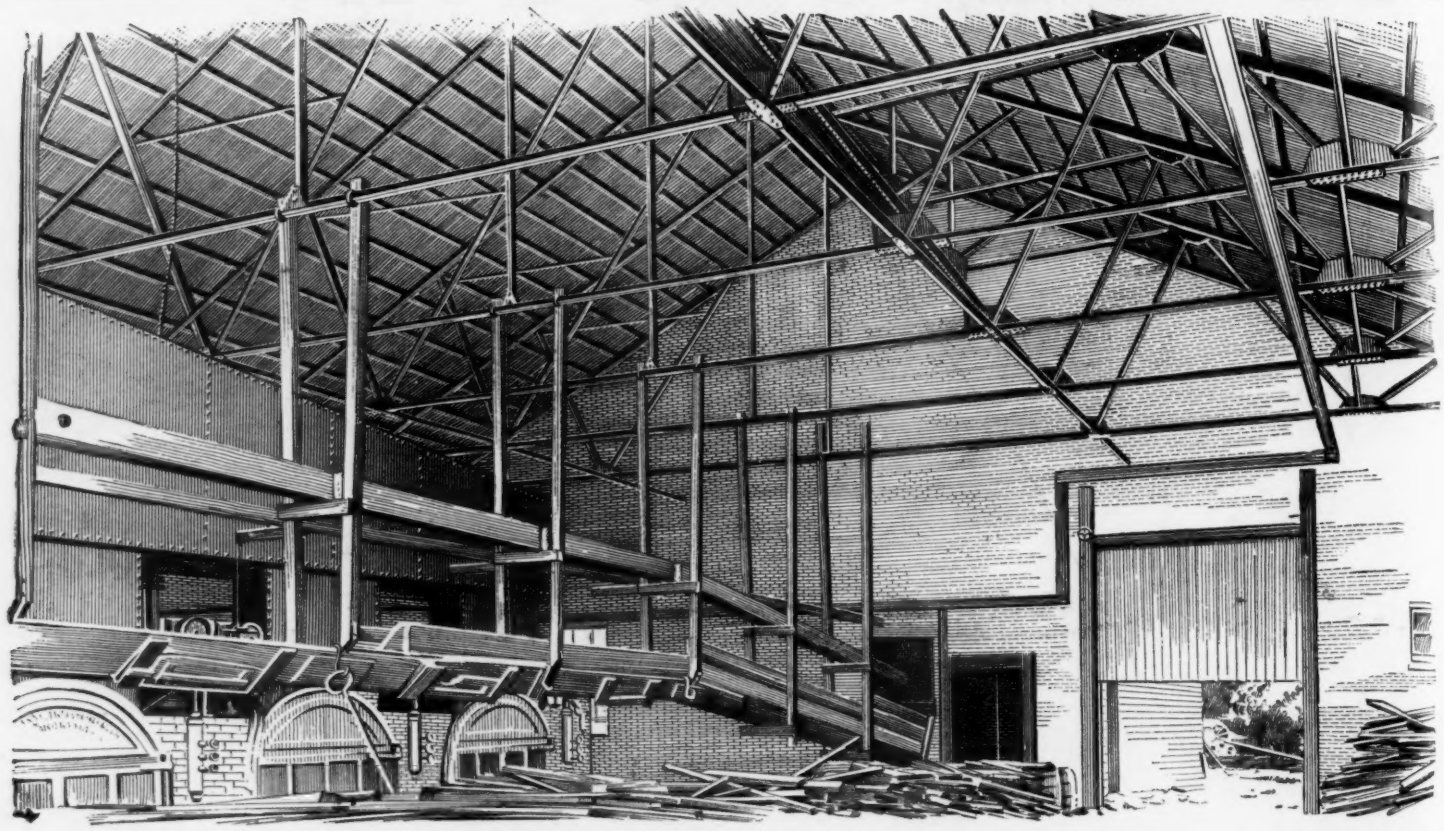

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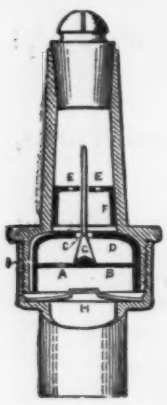

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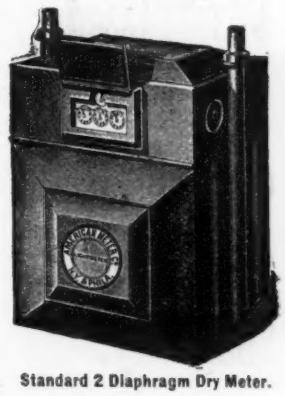

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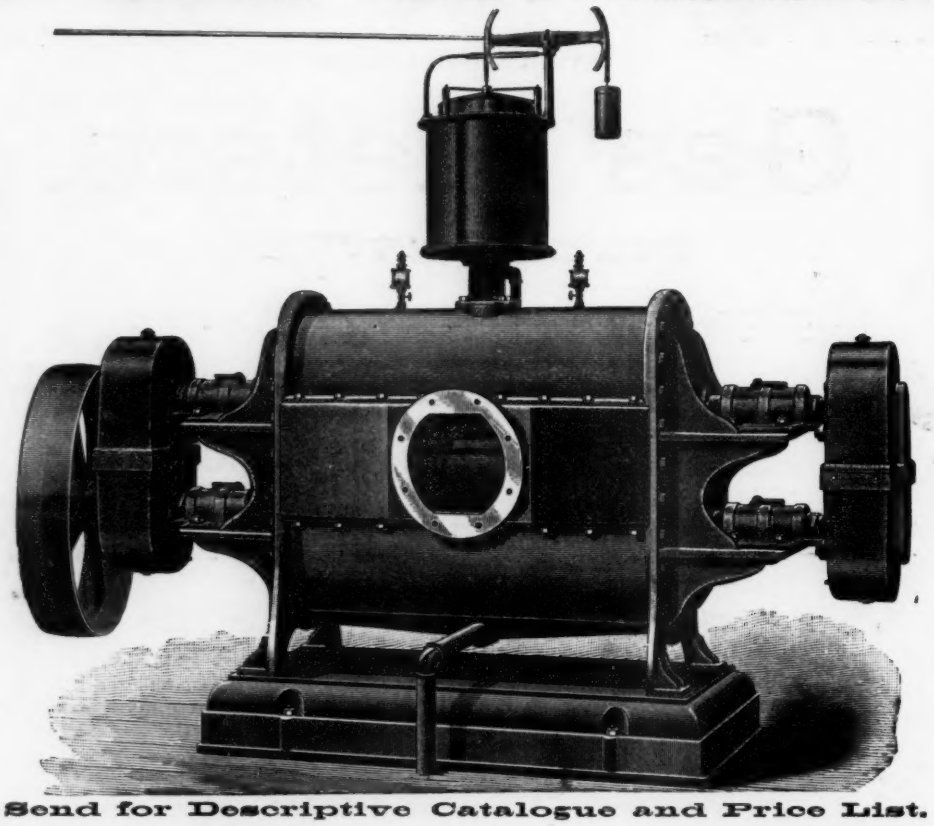

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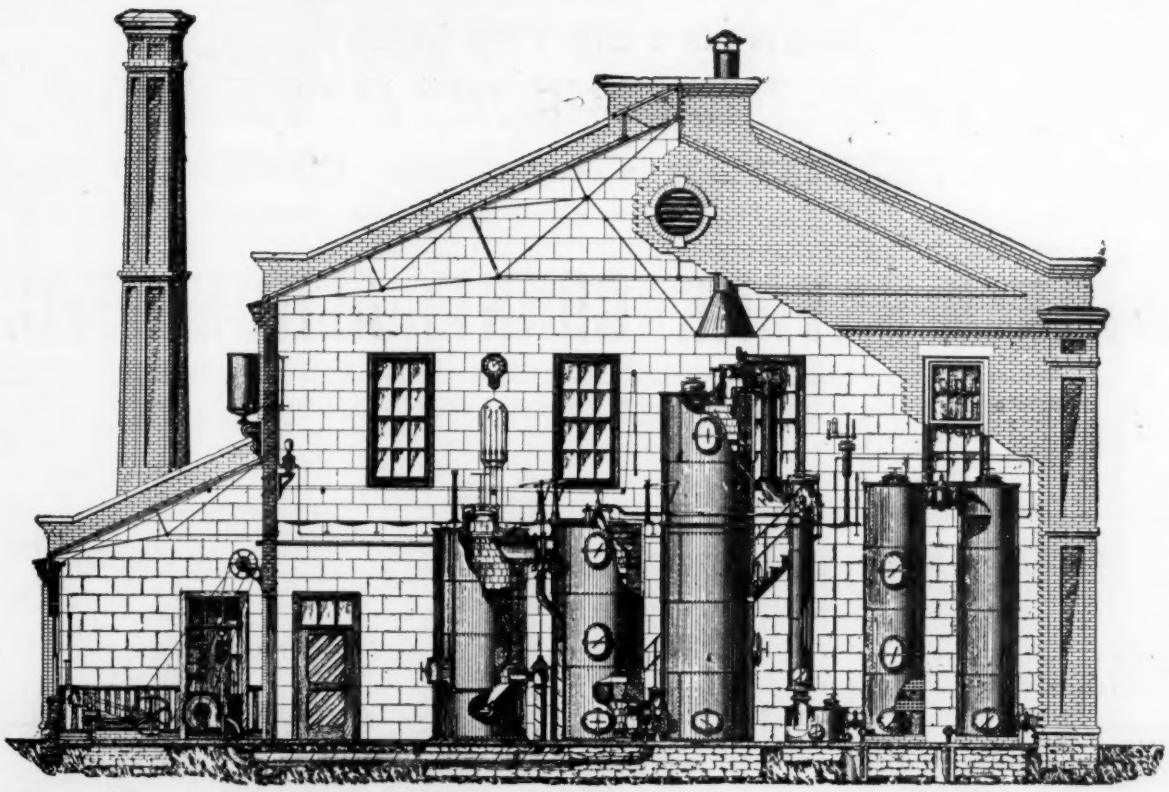

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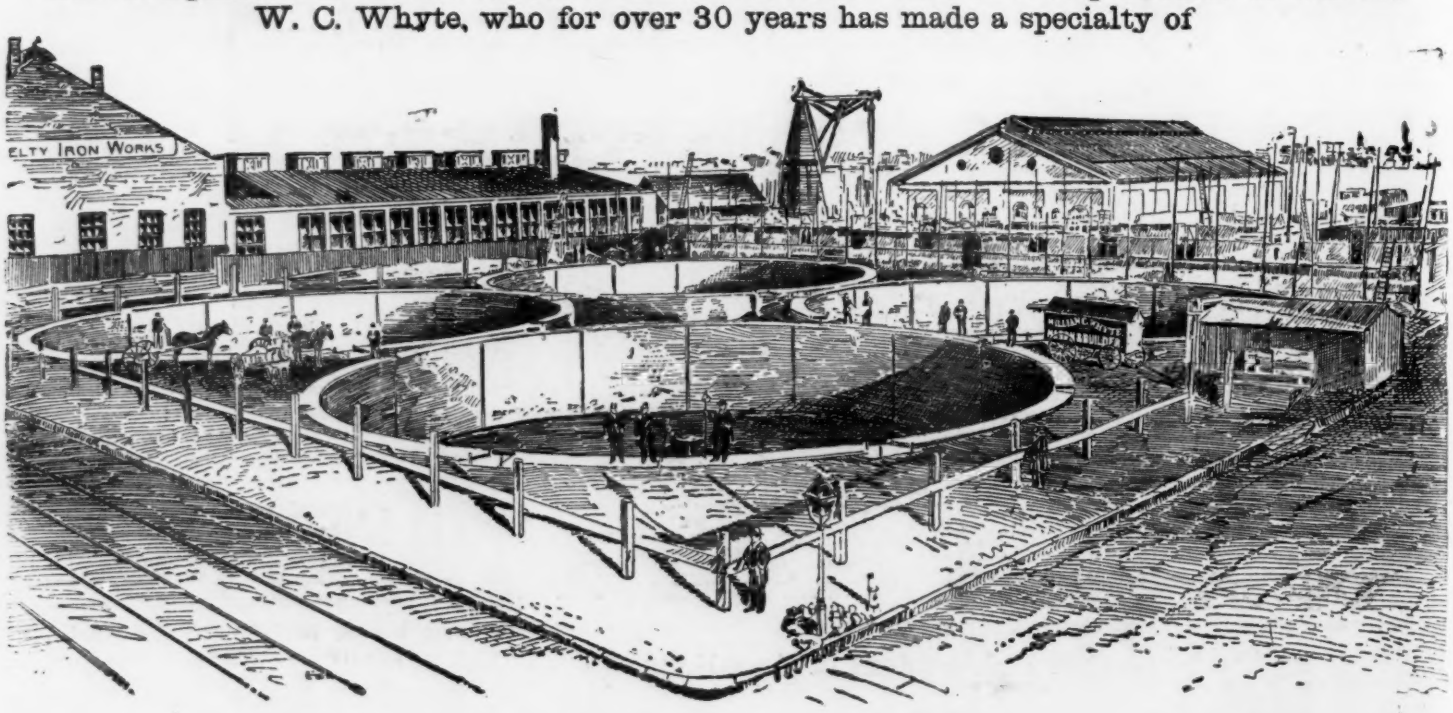

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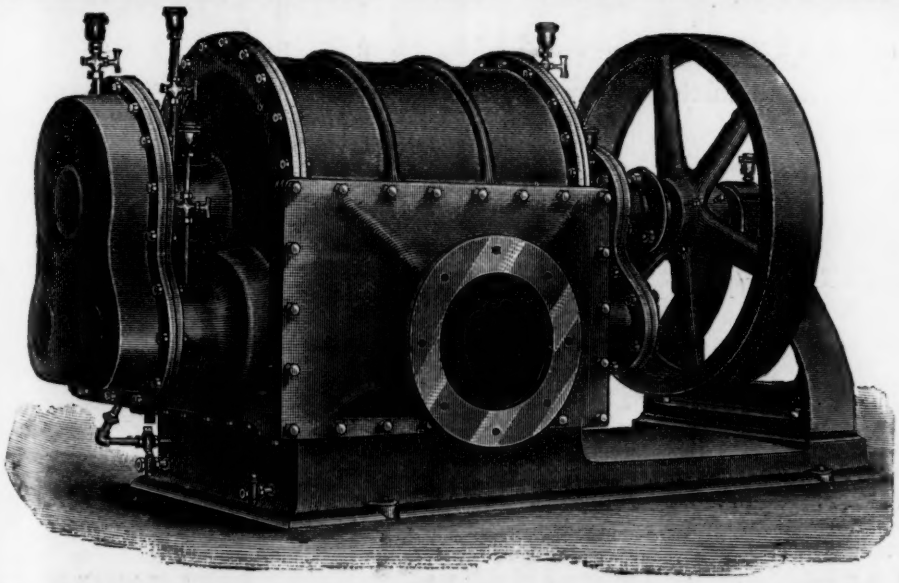

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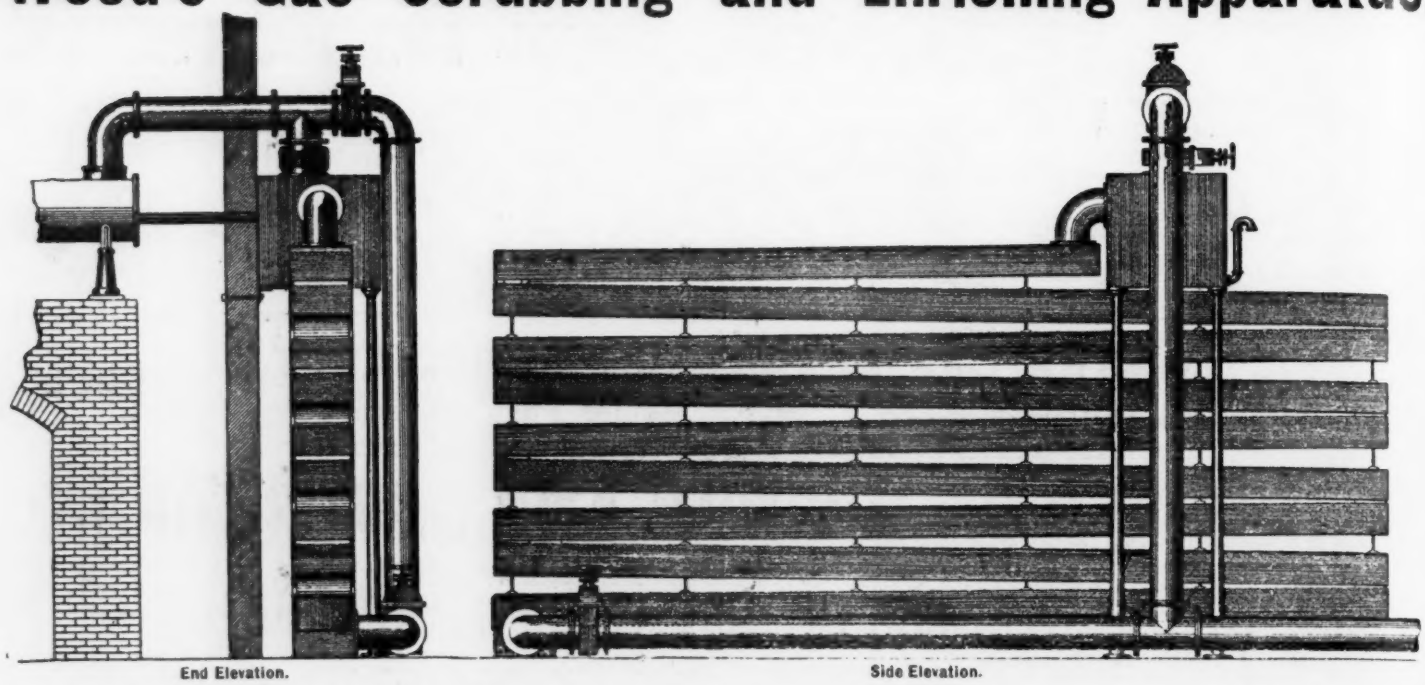

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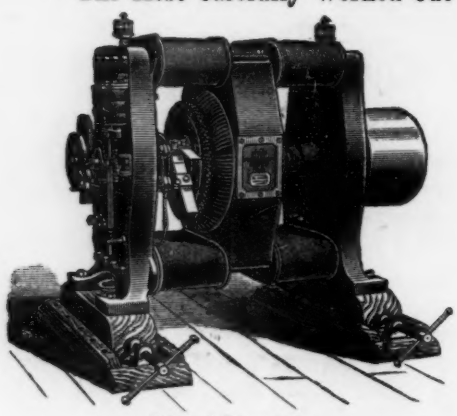

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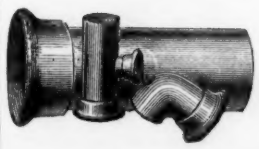

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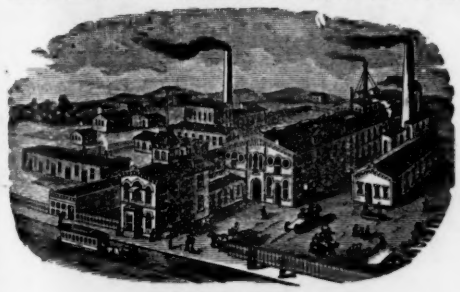

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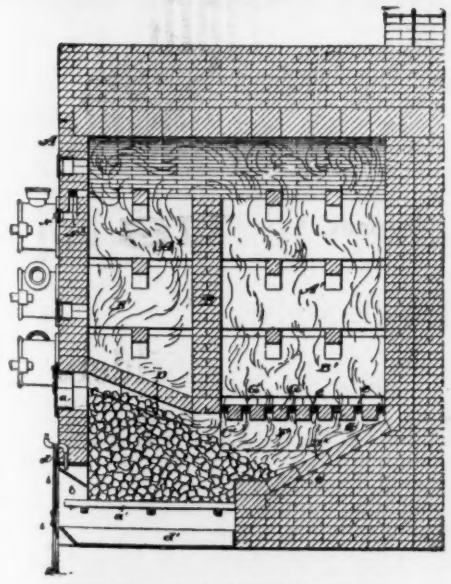

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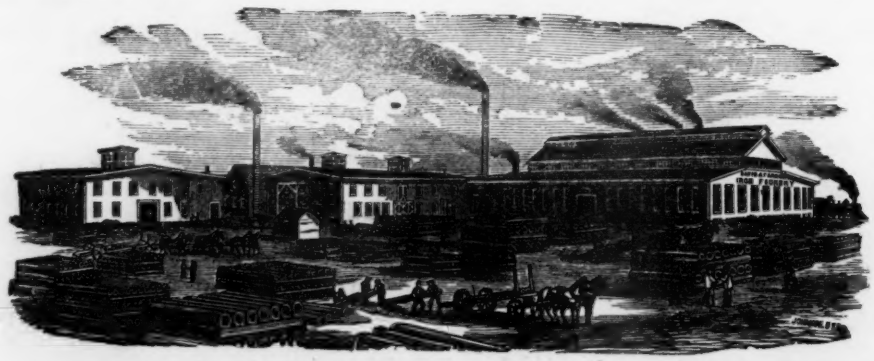

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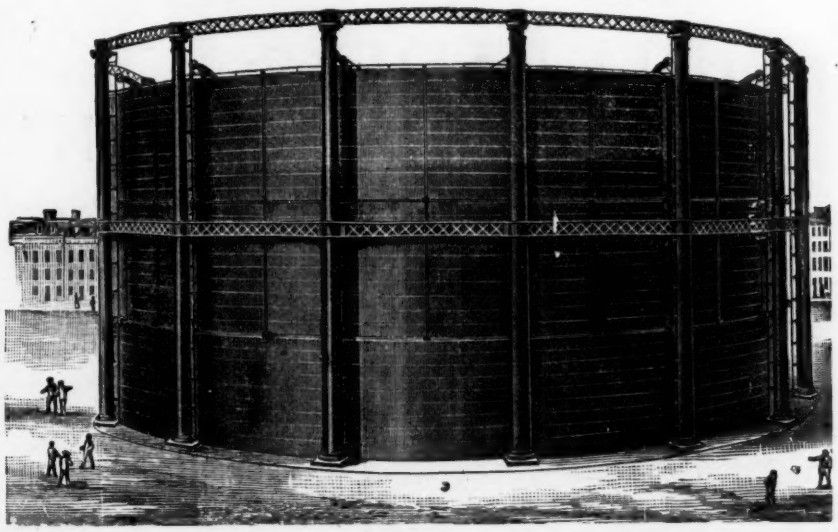

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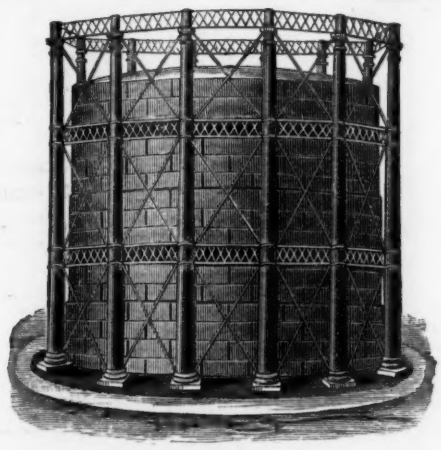

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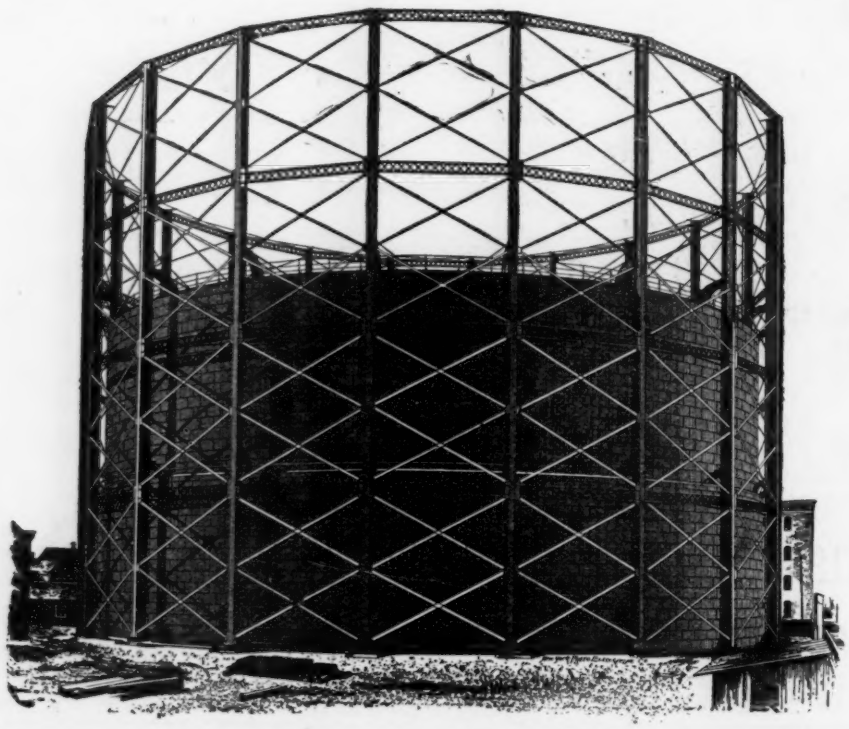

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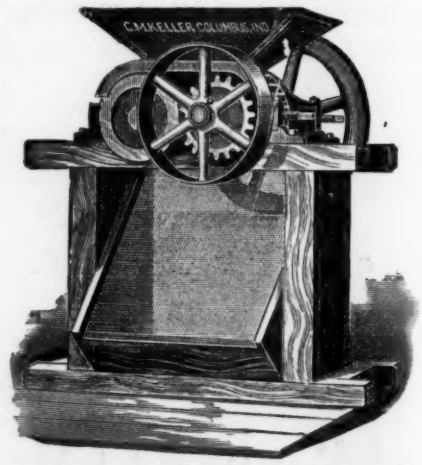

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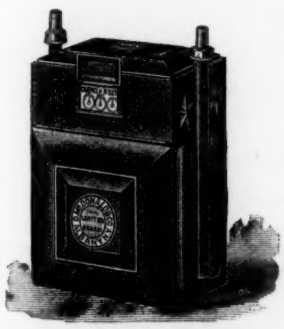

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